EXIT MUNDI

Isn't life a bitch? The world is going to end. You don't even have to be a religious fundamentalist to see that's true.

Some people collect postal stamps; Exit Mundi collects scenarios of what could go wrong with the world. Sure, our planet could get hit by an asteroid. But hey, that's nothing. Did you know we could all be munched away by hungry molecules? Or that our physicists could unintentionally wipe us all out while tinkering with particles? `Oops, sorry...'

Exit Mundi isn't in it for doom preaching, but strictly for fun. It's a fascinating thought: if that &*%# comet didn't wipe out the dinosaurs 65 million years ago, we wouldn't be here pondering about apocalypses and Armageddons in the first place. The dinosaurs roamed our planet millions of years longer than we did. If it wasn't for the comet, they still would.

That's why this site is a tribute to floods, quantum explosions and awfully big chunks of space rock falling out of the sky. If there's a lesson to be learnt, it should be that within every end looms the dawn of a new beginning.

Sounds good, doesn't it?

[SPACE]

Meteors – any day now

Whether you call it the Big One, the Great Exterminator, Lucifer's Hammer, or Extinction Level Event -- there's much to be said about big chunks of space rock slamming into the earth. One thing's for sure, however. It happened so many times before, that it's only likely it will happen again...

It all comes about within moments. Suddenly, there's a big, fiery ball in the sky, just for a few seconds. And then: impact.

The atmosphere will be on fire. A huge column of fire and debris towers up miles into the sky. Hundreds of thousands die instantaneously. For thousands of miles around, everyone outdoors is incinerated. People nearby simply evaporate.

The impact sends out a shockwave around the globe, just like a stone thrown into a pool makes a circle of waves. But this wave rolls through the Earth's crust itself, causing death and destruction everywhere. There are massive earthquakes. Huge tsunamis. Volcanoes popping open. Millions die, cities are shaken into oblivion. On the opposite side of our planet, the waves of destruction slam into each other again, causing the earth's crust to tower up, forming a massive mountain-ridge within seconds.

And that's just the beginning. As the tremor and the seas calm down and the fires extinguish, there's more to deal with: the huge, black cloud of debris that's thrown up into the stratosphere from the impact site. The debris spreads through the stratosphere, covering the Earth with a thick blanket of burnt carbon, dust and debris. The Sun is blackened.

For months or even years to come, the world is covered in darkness, the Sun being no more than a vague blot of light in the pitch-black sky. Temperatures drop about twenty to forty or even fifty degrees everywhere. The Earth's surface freezes. Plants cannot produce oxygen anymore by photosynthesis and die. Animals relying on the plants die too. And we -- relying on both the animals and the plants -- are in BIG trouble.

Oh, there are a few pockets of people still hanging on. They're hiding in bunkers, or in caves. They hold on for years, as long as their supply of tin cans lasts. But when they return to the surface after the endless winter night, they find their planet is turned into a barren, lifeless sheet of land, with only some deserted ruins reminding of what once was.

Sure: in the end, the Sun returns and temperatures start rising again. So there may be a new beginning for mankind after all? Think again. The odds run against such optimism. The only thing alive is bacteria and mosses and -- if we're lucky -- some insects, rodents and fish. With luck, civilization is `only' thrown back into the Stone Age. More likely however is that humanity becomes extinct.

A Brief History of Meteors Going Whammo

Oddly, until twenty years ago, no one took meteors quite serious. It was widely believed that those mean clumps of rock and ice that zoom across the galaxy are not a real threat to our planet. A comet entering our atmosphere would instantly burn up, and that would be it.

All that changed in 1978, when two paleobiologists, Louis and Walter Avarez, went to Italy to study the so-called **K/T barrier**: the transition between the Cretaceous period (the age of the dinosaurs) and the next prehistoric era, the Tertiary period. The K/T Barrier had always been a big mystery. Within only several thousands of years -- a twinkling of an eye, in geological terms -- all the dinosaurs suddenly vanished and nature switched from one geological period to the next.

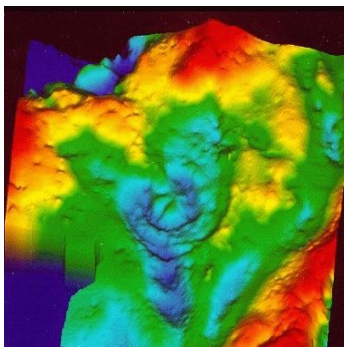
Digging around in the Apennine Mountains, father and son Avarez suddenly realized something extraordinary must have happened. Everywhere on Earth, the K/T Barrier is marked by a tiny layer of iridium in the ground -- `iridium' being a rare chemical substance mostly found in meteorites. It began to dawn on Louis and Walter that the dinosaurs didn't just die out because of some evolutionary reason. The dinosaurs were simply squashed by a huge meteorite!

The killer meteorite must have slammed into our planet 65 million years ago. It must have been an event much like the one described above. There was a long, mean period of darkness, while it rained iridium all over the world. Life on our planet was almost completely wiped out. All plants and animals bigger than a blade of grass became extinct. Just picture that! No wonder the Avarezes coined the killer meteor `**The Great Exterminator**'.

For the decade to come, the Exterminator theory was highly controversial. If a meteor big enough to kill all the dinosaurs really went boom on our planet, surely you should notice an impact crater somewhere? Then, in 1991, Nasa sattelites indeed spotted the crater.

It was a huge scar known as the `Cenote Ring', underneath the Mexican peninsula of Yucatan, almost impossible to detect by the eye because of millions of years of erosion and tectonic movement. Judging by the size of the impact crater, scientists calculated the Great Exterminator must have had the size of a mountain.

It hammered the world of those poor dinosaurs with the impact force of about 100 million megaton of TNT. That's the equivalent of *5,000,000,000* atomic bombs! By now, some people really started to get itchy about meteors.



Next came the impact of the comet **Shoemaker-Levy 9** on Jupiter. For the first time in history, man could see what actually happens when a colossal comet starts to mess around with your planet. In July 1994, the meteor slammed into Jupiter's atmosphere, snapped into pieces, and bombarded the planet for days. Huge balls of fire and dust rose up from the planet's surface, and the debris darkened parts of Jupiter's atmosphere for weeks. The biggest impact crater, carved out by the piece of meteor known as Hale-Bopp, had a size no smaller than the entire Earth! By now, everyone realized that

the danger of a meteor suddenly ending your world is as real as can be. It could happen next year, or next month. And well, it could also happen tomorrow.

From those days on, attention for meteors grew and grew. Were the dinosaurs just unfortunate? The troublesome answer is a loud and clear `no'. As a matter of fact, the meteor that killed the dino's wasn't the first big piece of rock hitting our planet -- and not even the biggest, scientists began to realize.

For instance, just over 4,5 billion years ago, when our planet was still very young, an enormous body hit Earth with such unimaginable force our planet literally broke up. A huge piece of Earth was launched into space. You can still see that lump of earth when you look out of your window: the debris rolled up into a ball, and is what we today call the Moon.

The next massive space attack came a half billion years later: our planet was bombarded so heavily with asteroids that the entire crust actually **melted**. That would explain why the oldest rocks on Earth are only 3,9 billion years old, while the planet itself is five billion years old.

And then there was another apocalyptic event, some 590 million years ago. One day, a meteorite of incredible proportions slammed hard into what's now South Australia, digging a crater about four kilometers deep and some 40 kilometers wide (currently known as Lake Acraman). Within seconds the whole thing vaporized into a huge firestorm. The impact was so devastating, it must have created massive earthquakes and 100-meter high tsunamis even hundreds of kilometers away. Oh boy!

Actually, it literally *rained* Big One's on our little planet. As recently as January 2002, geologists discovered a huge impact crater out of the Australian coast: no less than 120 kilometers wide. The meteor that carved out the crater slammed into our planet 360 million years ago, wiping out 85 percent of all species.

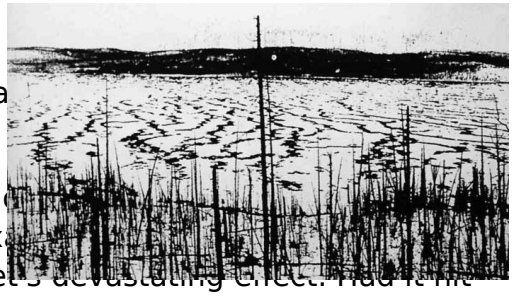
And in 2001, Norwegian researchers suddenly realized that their coast had once been the scene of a similar event. A huge meteor went kaboom over Norway 150 million years ago - speaking in geological terms, right before the Great Exterminator. The explosion slammed a 40-kilometer wide bump in the seabed of the Barents Sea, the so-called `Mjoelnir Crater'. Researchers still wonder how it was possible that *anything* survived.

Oh, and even when humanity was around, the meteors kept hitting us. For example, according to some researchers, the legendary floods of Deucalion, the Sumerian Gilgamesh-epos and the biblical Deluge may very well have been caused by a big comet plunging into sea somewhere.

More recent, in the year 1490 A.D., the city of Ch'ing Yang in Central China was the scene of a weird disaster. The event was recorded in at least ten ancient textbooks, all claiming that the event killed many thousands of people as it `rained stones and fire'. Likely cause: an asteroid as big as a modest sky scraper, going kaboom high up in the Earth's atmosphere.

On June 30th of 1908, a loud explosion shook the village of Tunguska in Middle-Siberia. Local inhabitants saw a huge blast of fire in the sky. There was a sudden temperature rise, and a blazing forest fire, lighting up the horizon. No less than two thousand square miles of forest were devastated. As we know now, a twelve story building sized piece of rock hit the atmosphere over Siberia and exploded at a height of some eight kilometers. The energy set free at the event was equivalent to 15 megatons of TNT -- a thousand atomic bombs!

So, it's no pessimistic estimate that our planet can bounce into a freaky piece of space rock again. Cosmologists estimate an extinction type comet hits the earth once every 20 million years. The odds for a smaller, Tunguska average, this kind of thing happens once in every



Of course, the effect of a meteor impact depends Earth. The meteor that killed the dinosaurs, for ex sulfuric rock, which enormously boosted the comet's devastating effect. Had it hit the planet several hundreds of miles westwards, it would have plunged into the ocean -- and the dinosaurs probably would have survived. On the other hand, if a Tunguska-type meteor happens to hit an inhabited area, it will definitely wipe it off the face of the Earth entirely. Considering that some 10 percent of our planet is inhabited, you could assume that once in every 3,000 years a meteorite will destroy an inhabited area.

Meanwhile, the people at Nasa try to reassure us, by claiming they keep an open eye to the sky. The message they propagate is that a meteor that wants to hit our planet surely will be spotted in time and destroyed -- whether it is by a nuclear bomb or by a team of Bruce Willis-like he-men going out in a space shuttle.

No offense -- but that's pure propaganda. The harsh fact is that such `protection' is far less reliable than Nasa wants us to believe. For example, in March 1998, a BIG comet nearly hit us. Remarkably, no one saw it coming. Because it came straight at us, the thing was only visible as a tiny speck in the sky, not as a distinct, moving object traversing the cosmos from left to right. Consequently, no one noticed it -- until it passed.

Meteor size	Impact force	Destruction rate	Chance (est.)
50 m. across	15 Megaton of	City sized	1:300

	TNT		
200 m. across	100 Mt TNT	Continent sized	
1,000 m. across	100,000 Mt TNT	Half of the world	1:2,000,000
10,000 m. across	100,000,000 Mt TNT	Extinction level event	1:30,000,000

- **Death statistics.** The Norwegian meteor was 2 Kilometers across; the meteor that carved out Lake Acraman in Australia 4 Kilometers, and the comet that killed the dinosaurs 10 Kilometers. The impact force also depends on the velocity of the object, which ranges roughly from 50,000 to 100,000 Kilometers per hour.

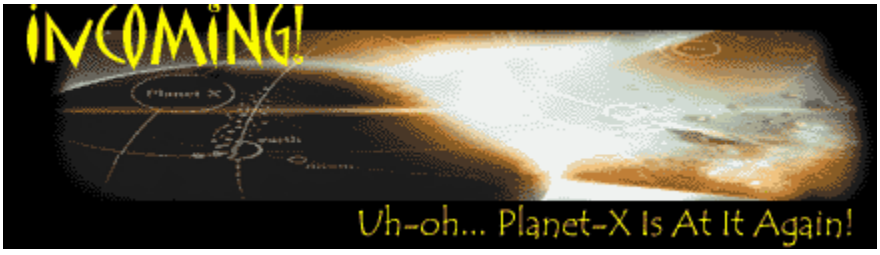
Then there's the eerie problem of ice comets. Many comets are in fact `dirty snowballs' made of dust and ice. The problem is we cannot really detect these comets, because conventional equipment sees right through them. You can only spot an ice comet when it comes so close to the Sun that it begins to melt. We'll recognize it by its tail by then. But according to many critical astronomers, this will be much too late to take any action.

Besides, there are no reliable ways of getting rid of a comet racing at us. Pleas for a kind of `space shield' protecting us from big pieces of rock have not yet raised any political backing. And it is doubtful whether Bruce Willis is willing to go out to kill the Big One if it's coming.

Oh, and talking about Big One's: in 2039, another HUGE comet will pass us by `only' some millions of Kilometers. However, this estimate is not completely fireproof, for one thing because comets are very sensitive to variations in their trajectory.

Here's what to do. Put on your best helmet -- and keep your fingers crossed.

Planet X – any day now



The Sumerians saw it. The Russians photographed it. NASA saw it, too. And now, eons after it left our world behind as a smoking, lifeless mess,

the dreaded Planet X is about to reenter our solar system and mess up our world all over again. Or is it?

They say it triggers earthquakes. That it rips open volcanoes, and unleashes massive tsunamis. They say it can kick the Earth's axis over, pushing Africa to the pole and Antarctica to the equator. It may even stop our planet from rotating! Or worse: peel the Earth's crust off, tear our planet to bits. Or perhaps it simply sweeps our world aside, pushing it into the Sun. That's the way it goes when suddenly, a HUGE planet zooms by. They say.

The demon planet that is supposed to do the trick goes by many names. Some call it Nibiru, or Marduk. Others named it The Ottawa Object, or Vulcan, or Transpluto. But most people prefer X, just X. `Planet X', to be precise.

Planet X is the supposedly eleventh planet of our solar system. It should be as big as many Earths, dwarfing it perhaps even hundreds of times. Some people think X isn't even a real planet, but a `brown dwarf': a massive ball of dust and gas that almost succeeded in becoming a star. Planet X has something no other planet has: a huge orbit. Its orbit around the Sun lasts 3,600 years. Most of the time, it is far off, invisible to the eye. But every 3,600 years, the lost planet returns. Once here, it accelerates, and swings close past the Sun, disrupting everything it encounters.

And that's exactly what Planet X is about to do, they say. Right now, it should be somewhere in the outer regions of the solar system, still invisible to our telescopes. But in the spring of 2003, it will suddenly make its appearance. It will be some event. Within months, Planet X will reach the inner regions of the solar system, disturbing the eclipses of the planets and bombarding us with comets. In May, it will pass Earth, missing it only at a few hairs' lengths. Or, well: hitting us at full force, perhaps.

And that will be it. X will fly off again, not to be seen for another 3,600 years. And our planet? Earth will be bruised and battered, and covered in lava. If there's anything worth calling a planet left at all, that is.

Planet X: The Real Story

Then again, maybe nothing happens at all in 2003. You see, Planet X is like the perfect myth: the outcome of centuries of ill-omened rumors, laced with snippets of history and cosmology. But: it is still myth. Dream stuff.

It all began with a tablet of clay, uncovered in the Near East many years ago. On the tablet, the Sumerians, the earliest known inhabitants of the Middle East, jotted down something that looked like a solar system. Earth was there, and Saturn, and Jupiter -- as well as all other planets we know of today. But hey, aren't there supposed to be **nine** planets? The clay tablet clearly displays eleven. The tenth one

could be the moon, or the newly discovered mini-planet Sedna. But that still leaves you with one planet too many. Weird, isn’t it?

Ten: The famous `Berlin seal', displaying one planet too many.

Next came the astronomers.From the 1840s until deep into the 1980s, astronomy was haunted by a strange mystery. Something was not right with the orbits of the outer planets. Something really heavy seemed to be tugging at the outer planets Uranus and Neptune. Certain asteroids felt the mysterious pull, too. Must be an enormous planet out there, many astronomers assumed. Or several planets, even. This was how Planet X got its name: the term `X’ comes from the early-twentieth century astronomer Percival Lowell, best known for his study of the `canals’ on Mars.

But eventually, in the 1980s and 1990s, the riddle was solved. There appeared to be no mystery planet involved at all. Neither is there some mysterious force pulling on Neptune’s orbit. The astronomers simply had their orbit calculations wrong. But with better techniques, it all added up. By now, no serious astronomer believes in Planet X anymore. Exit Planet X.

But it was too late already. The Planet X-story had started to lead a life of its own. The breakthrough came in 1976, when a new age-writer by the name of Zecharia Sitchin linked the Planet X-problem of the astronomers up with Sumerian and Babylonian mythology.

Enter Sumerian religion. Like most people, the Sumerians had a lot of pretty neat stories about how the Earth came about. In one of them, it all began with a family quarrel between two gods, Tiamat and Marduk. The two picked a fight, and Marduk won. Pissed off as he was, Marduk cut Tiamat to bits. From the body parts he created our world. This leg here is the sky; that arm there, that'll be the land.

But Sitchin turned the story upside-down. To his opinion, the Sumerians were actually describing an ancient cosmic disaster. A collision between our own planet (Tiamat), and Marduk -- which was, of course, the mystery planet from the clay tablet, a.k.a. Planet X. Adds up nice, right?

Well: it doesn't. For one thing, Sitchin's translations of the Sumerian texts were terrible - for example, he got the word for `planet' wrong. And the words Nibiru and Marduk? Marduk was, besides a god, a nickname for the planet Jupiter. `Nibiru' simply means `ferry boat' and was sometimes used to describe... Jupiter! So in fact, what Sitchin holds for Planet X is simply good old Jupiter.

The astronomical side of the story is no good, either. A planet with a highly elliptic orbit of 3,600 years would after a few rotations fly off, direction deep space - or just

become part of the 'normal' solar system. It is simply impossible there is a Planet X around. Physics forbids it, just like it forbids apples from falling upwards.

But how about the ten planets on the Sumerian tablet? That's decoration, probably. Or it could be Venus, as seen from Earth, and surrounded by stars. There are many, many clay tablets exactly like this one, and they all display funny little drawings in the corners: crosses, moons, stars -- you name it. So there's no need to think anything special of the `planets'. We can be sure of one thing, though: it isn't a astronomical map. The Sumerians believed our planet was a flat disc, they didn't believe the planets rotated around the Sun, and they had no way of seeing the outer planets Neptune, Pluto and Quaovar.

Still, Sitchins book was a bestseller, and Planet X gained quite a following on Earth. It still has. Some believe Planet X is an inhabited planet, inhabited by Atlantians, or pyramid-builders, or little green men, or... well, you know, that sort of thing. Even today, there are people around who claim they are in `telepathic contact' with the inhabitants of the planet. Sigh... Some people will simply believe anything!

Aw... Hold it now. Is that all? Well, there's this other thing. For in fact, Planet X has been spotted by NASA! In 1983, two astronomers named Neugebauer and Houck made headlines with their announcement that they had discovered a `Jupiter-sized planet', cruising the galaxy at a distance of two billion kilometers from the Sun.

But: the headlines were wrong. What Neugebauer and Houck really told the press was that they discovered an irregularity in the infrared spectrum. It could be almost anything, they stated, ranging from a new planet to a distant galaxy. The press obviously preferred the planet. But after a while it became clear that what the astronomers really saw was a distant galaxy.

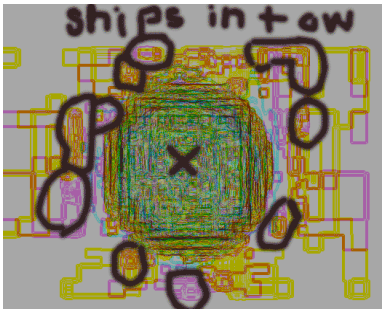
By now, numerous pictures, news clippings and remarkable facts `proving' the existence of the dreaded Planet X are circulating the Net. But don't stock on tin cans: they're all bogus (for the details, check out the fact sheet at the bottom of this page).

It is at this point many Planet X-believers resort to gossip and childish, X-filish conspiracy theory. According to one particular rumor, the astronomers hold back all information regarding Nibiru. The Russians would have taken photos of Planet X, including affirmed alien space ships hovering over its surface (see pictures below). Another rumor has it the coming of Planet X is covered up by hushy governments -- isn't that why so many observatories are closed down for maintenance? Oh, sure! You must have a Sumerian clay tablet for a brain to buy stuff like that!

So: Planet-Ex?

You guessed it. If they ever start telling you about Planet-X, laugh your wits off. Don’t take any precautions – there’s no need. Planet X doesn’t exist. Never has. Never will. Off with you, Nibiru. Shoo.

[Credit: For the Sumerian part of the story, Exit Mundi owes a great deal to Wilfred van Soldt, an expert on Mesopotamian astronomy at Leiden University who was willing to look into the case. Also, Exit Mundi consulted Frank Israel, an astronomer at the same university. The insight they offered is invaluable, thanks!]



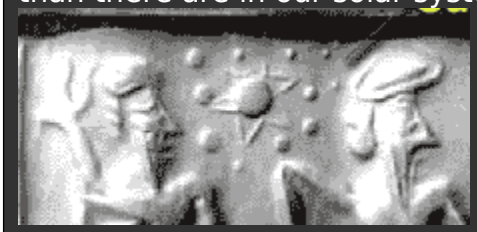
Ultimate Evidence? - On the Internet, there's a picture circulating that's supposedly `secret evidence' from Russia, proving Planet X is an inhabited world. The makers took the original photo (top left), enlarged it, and upgraded it with `solarize' and `find edges'. And look... Suddenly, you see all kinds of spaceships orbiting the planet! (top right)

I followed exactly the same procedure, using a photo of one Robert Bridson, math student at Stanford University (below, left). After enlarging and solarizing the photograph, it became clear that Mr. Bridson’s left ear actually is inhabited by intelligent beings, since there clearly is a spaceship taking off from it (below, right).

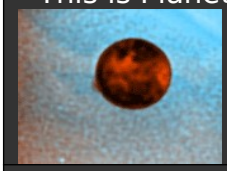
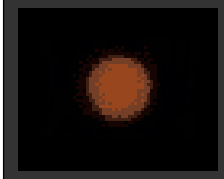
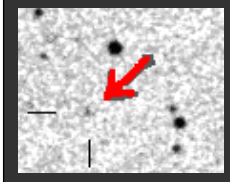
The `Evidence’	The Facts
- There could be such a thing as a Planet X around.	No, that's impossible. Planet X is said to have a highly elliptical orbit. But such orbits are unstable. Soon, the planet would get a circular orbit and become part of the 'normal' solar system - or it would fly off into deep space. There just is no other way.
- Sumerian mythology tells of a collision between two planets.	No, it doesn’t. In one particular Sumerian creation story, Earth is created after a violent conflict between Tiamat and Nibiru. But neither of them is a planet: they’re gods, the two of them. It was the writer Zecharia Sitchin who introduced the planets, not the Sumerians.
- The Sumerians knew of a planet they called `Nibiru'.	Wrong. `Nibiru' is just the ancient word for `ferry boat'. In some Babylonian texts,

	the word `nibiru' is used to describe the movement of the planet Jupiter - which was also called `Marduk'. So neither Nibiru nor Marduk refers to some weird planet. It just means: Jupiter! Nothing more, nothing less.
- The Sumerians knew very much about cosmology. That’s why you should take it serious when they say there is a Planet X around.	Wrong. Indeed, the Sumerians had the same amount of brain as we have. But they weren’t interested in astronomy at all. That came later, with the Babylonian civilization. And even then, the Babylonians believed Earth was a disk, with the Sun revolving around it! Just look at it this way: the Greek, the Chinese and the Maya knew lot more about cosmology than the Babylonians and the Sumerians– and *they* never mentioned a tenth planet!
- The Sumerians had a pictorial word, `shar', that means `planet', `orbit' and `3,600'. This must refer to the fact that Planet X has an orbit time of 3,600 years.	Far from it. 'Shar' means '3,600' alright. But in another language, Akkadian, there was a pictorial 'sharru' which meant 'Marduk' or 'supreme ruler' -- and nót `planet'. The mixing up of two completely different languages, once again, comes from Sitchin.
- The Babylonians frequently used the letter `X'. This means: `planet of the crossing'.	No, it doesn't. The Babylonians used X much like we do: to mark things. In specific, they used X's to mark their kettle. But the X doesn't refer to anything that has to do with planets.

- Planet X must have slammed into our world: that’s why the once-joined continents are split up and floating away from each other.	Total nonsense. The force that pushes the continents apart doesn't come from outer space – but from deep underneath the Earth’s crust. In the Atlantic, new seabed is constantly being formed, and this pushes the continents apart.
- Still, something huge *did* slam into our planet – modern science agrees on that.	Yes, but that particular event took place 4,5 billion years ago. In those days, a huge heavenly body cleft our planet in two, creating the Moon. But there weren’t evensingle-celled bacteria around at that time. Let alone Sumerians with clay tablets to write about the event.
- But the Sumerians were in contact with an alien race. They told them all about Planet X.	There is not a shred of evidence to support such hocus-pocus. Think of it this way: if the ancient Sumerians indeed were such good friends with an alien race, then why didn’t they even have the technology to prevent their culture from being run over again and again by invading neighbors? The Sumerians were pretty simple, rudimentary farmers that lived off of the land.

- But still, there's the `Berlin Seal' (also known as the `Akkadian Seal'). On it, you clearly see more planets than there are in our solar system: 	But what you see isn't a map of the solar system at all. It's decoration, probably. Or a picture of Venus, as seen from our planet, and surrounded by stars. The ancient Babylonians made funny little drawings like this all the time. And they all looked different. So it's just coincidence this one resembles a solar system. We do know for sure that it isn't a map, because the Babylonians believed the Earth was the center of the solar system. No Babylonian would have placed the Sun in the center. Besides, the `map' is full of errors. The planets are out of proportions and Saturn has no ring. And obviously, there are too many `planets'.
- Joshua tells of a `long day' – while the West Coast Indians have stories of a `long night'. That's a clear indication the planet stopped rotating for a while when Planet X last came by.	No, that is impossible.Planets cannot just stop rotating for a while and then start again. Physics forbids it. And hey, if you'd read enough ancient writings, you would find `evidence' for almost *anything*!
- Still, around 3,600 years ago, something awful *did* happen. There's	Yes, but a volcano and not Planet X was the

a lot of evidence telling us that the world was struck by disaster.	culprit. Around 1628 BC, the Greek volcano of Thera erupted, causing darkness even in China and a sudden, sharp climate drop all over the world. That's bad enough, but eruptions like these happen all the time. What's more, Thera was still a relatively small volcano, as you can read elsewhere on this site. It is worth noting that none of the ancient texts about the Thera disaster mentions anything about unusual events in the sky.
- Many astronomers believe Planet X exists. And for good reason: there’s some mysterious object tugging at the orbits of Neptune and the outer asteroids.	Not anymore they do.Indeed, for almost 150 years, astronomers assumed there could very well be another planet out there. But by now, we know that the astronomers were wrong. They simply didn't have the orbits of the outer planets correct, because they lacked the tools. By now, we know there is nothing strange about the orbits of the outer planets. And since then, the calculations add up fine.
- There's good geological evidence for Planet X. Once in a while, Earth is struck by mass extinctions. These extinctions show a very regular pattern, suggesting the planet is struck by disaster periodically.	Not true. Indeed, in 1984, two renowned palaeologists claimed the discovery of an `extinction pattern'. Every 26 to 30 million years, there's a `wave' of extinctions. But they withdrew that theory later. When you look over a longer period of time, there's no pattern to be found at all. Besides, the palaeologists

	weren't thinking of Planet X -- but of a twin Sun calledNemesis.
- NASA has photographed Planet X in 1983	No, they haven't. In 1983, the IRAS satellite spotted something unexplained that turned out to be a new type of very distant galaxy. But for lack of anything better, the press concluded that NASA had spotted a tenth planet.
- The Russians have photographed Planet X in their `Norlock'-project.	That's a hoax. There's no such thing as a secret project called Norlock. The hoax was set up by someone claiming to be an anonymous Russian scientist who had `finally decided to share this important information with the world.' Yeah, sure.
- This is Planet X: 	Nope. It's Io, moon of Jupiter. The picture was taken by the Hubble Telescope in June 1997.
- This is Planet X: 	Nope. It's a hoax: the resolution of the planet differs from the resolution of the surrounding galaxy.
- This is Planet X: 	Nope. It's exactly what it looks like: a bad space photo with a vague dot in it, thousands of times too faint to be a nearby planet. It's a distant star, probably.
- Planet X is definitely closing in. You	Total rubbish. Even if there

can tell by looking at the volcanic activity. Over the last few years, this has been increasing.	were a huge Planet X heading our way, it wouldn't affect our volcanoes. The gravitational effect of Planet X would be only a tiny fraction of the gravity of Jupiter. And *that*, in turn, is just a tiny fraction of the gravitational pull the Sun and the Moon exert on our planet every moment of the day. Indeed, volcanic activity slightly increased over the years 1970-2000. But that may be coincidence, or, more likely, the result of more accurate equipment.

If you think you have other `evidence', you'll let me know, right?

THE MOON – any day now

Phew, that was close! A colossal asteroid just came by. It narrowly missed the Earth -- and smashed up the moon instead. Well, no reason to be cheerful. For without the moon, we could be just as doomed.

Just look at that moon. Isn't it lovely? But beware: the moon isn't just there to entertain us. Without the moon, we could be doomed.

There's always the small but alarming possibility that some dreadful cataclysm takes out the moon. Some billions of years ago, this almost happened. On one terrible day, a vast comet struck the moon, carving out what's now known as the

biggest impact crater of the entire solar system: the Aitken Basin, a huge, 2,500 kilometers wide scar on the moon's South Pole.

Ok, but what's the big deal you ask.

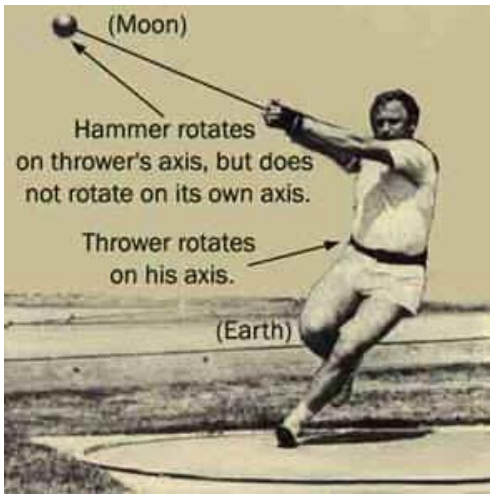
Well, not too many people know this, but the moon is what keeps our planet stable. Without it, we would find ourselves on a hostile rollercoaster world. Our planet would go berserk.

For one thing, the moon tugs at the oceans. This gives us the tides. No moon, and the floods would immediately be about 2,5 times lower -- some minor tidal motion would remain, because the Sun pulls at the oceans, too.

The consequences would be dramatic. Many fertile deltas would dry up. Other areas would become permanently inundated. There would be all kinds of changes to nature. All over the world, people would face droughts, famines, diseases and wars.

And to cheer you up a little more: that's not the worst part.

Crucially, the moon also stabilizes the axis around which the Earth rotates. You could compare the Earth-moon system to an athlete swinging a hammer around. Take a good look at the picture on the right. Now, ask yourself: what would happen if the rope suddenly snapped? You get the idea: the athlete would fall over.



Swing It Out: The moon and the Earth are locked into a twin system, much like an athlete about to hurl a hammer.

Exactly the same thing would happen to the Earth if you took away the moon. Right now, our planet rotates at an axis that is tilted about 23 degrees. It has always roughly been that way. But without the moon, the Earth's rotational axis would slowly drift off, because of the pull of the other planets -- especially Venus and Jupiter. So one moment you're in Africa; the next, you're on the North Pole!

In the long run, this would cause massive, unpredictable and abrupt climate shifts. The Earth would heat up, freeze up, and heat up again. One moment, your nose freezes off in a massive Ice Age. The next moment, you find yourself sweating your eyeballs out, in a period of soaring heat.

Even worse, our planet could tip over and 'lie on its back' for some millions of years (or longer). One half of the globe would be in constant sunlight, while the other half would be plunged into everlasting darkness -- and in cold.

We'd have a two-sided planet. And to be honest, you probably don't want to live on

either side. The southern half would become a barren, waterless, roasted desert world. The northern half would be an equally barren, dry, ultra cold ice world.

Ok, so you decide to live in between the sunny and the icy side. There, you might find a small zone with good old days and nights, and mild temperatures. But there's a downside: the region will be harassed by HUGE, everlasting storms. With temperature differences like that, there would be massive flows of air between north and south.

And actually, that's not even the biggest concern. For chances are the massive, abrupt climate shifts will at some point kill our world altogether. With the moon gone, our world could become a lifeless, dead planet in the end. The sweeping climate shifts could at some point disrupt the Earth's atmosphere for good. This is probably what happened to Mars (once watery and friendly, but now as dead as a doornail). Mars indeed tilts like a drunken athlete: it tips over to about 60 degrees!

And that's not everything. When the moon gets smashed up or knocked off course by a super big asteroid, it'll probably rain debris on Earth for many years. For years, we'd have to wear hard hats - only to find that hard hats don't help against big, incoming chunks of moon rock falling down on our world.

Howling at the moon

Still, there's some good news, too.

According to some doom prophets, without the moon, our planet would start spinning wildly, like a whipped top. A day and night on Earth would last only an estimated four to eight hours. And we would have HUGE, apocalyptic storms, tens to even hundreds of times stronger than anything ever seen on Earth, and each one of them lasting many years. Cities and forests would be flattened, agriculture would become impossible.

But fortunately, the doom prophets saying this have got it all wrong.

The moon has slowed down the rotation of our planet for good. The moon puts the brakes on our planet, because the tides serve like a sort of 'counter weight'. Over the billions of years, this has slowed down the rotation speed of the Earth. But if some rogue black hole suddenly snatched away the moon, our planet wouldn't suddenly start to whirl. It would in fact even slow down some more, because of the Sun's pull.

Another often heard, but wrong, horror scenario is that the moon is about to leave us for good.

Indeed, the moon IS leaving us. Very, very slowly, it creeps away from us, inch by inch, year by year. The moon flies off at the speed at which fingernails grow: 3,8 centimeters per year.

But that doesn't mean the moon will be lost in space eventually. Calculations show that in about 15 billion years time, the moon's orbit will stabilize at a distance of about 640.000 kilometers. If you looked up from our planet, you would notice that the disk of the moon was much smaller than it is now -- only about three quarter its present size.

Not that you would be here looking at the moon. Within 5 billion years or so, the Earth will become a dead, inhabitable world because the Sun has swallowed us by then -- but that's another story.

So all in all, next time you see that lovely moon up there, better be grateful. For now, things are just right the way they are. No sweeping storms, no ice ages, no falling over of the Earth. Let's hope it'll stay like that for some time.

(A big celestial thanks to Dr. Frank Israel (Leiden University) for technical advice)

NEMESIS – AD 13,000,000

Now don't panic. Somewhere, deep in the galaxy, a huge demolition ball of gas and dust is racing straight towards us. It's so dark you can't see it, but it's there all the same. What's worse: when it visits our solar system, it will create havoc and destruction on Earth.

`**Nemesis**', is the ominous name scientists came up with when they began speculating about the sinister space body in 1984. They couldn't have picked a better name: if Nemesis really exists, it should be one of the worst

enemies of life on earth. Our solar system is what Nemesis calls `home'. And the bad part is: home is where Nemesis is heading.

What Nemesis is? It's nothing less than our Sun's twin brother. Yes, that's right: a second Sun! In the cosmos, many stars come in pairs. And according to the Nemesis theory, our `star' -- the Sun -- is no exception.

But wait -- why then do we see only one Sun? Well, for one thing, Nemesis is REALLY far away at the moment. Nemesis orbits the Sun in a huge ellipse, with its furthest point a distance of three light years away. But once every 25 to 30 million years, Nemesis closes in on the Sun. It slams into the outer regions of our solar system: a place called the **Oort Cloud**, at a distance of about half a light year away from the Sun.

And that would mean trouble for us tiny earthlings. The gravitational pull of Sun #2 would cause mayhem in the belt of cosmic debris that makes up the Oort Cloud. Comets and meteorites would fling off in all directions, at unimaginable speeds. For many thousands of years, our solar system -- including Earth -- will be bombarded with comets. And we all know what happens to terrestrial life when someone starts gunning our planet with colossal pieces of space rock.

Well, if Nemesis really is a star, we'll surely see it coming, right? Wrong. In fact, the Sun we're talking about here doesn't shine at all. Nemesis is what is known as a **brown dwarf**, a dark ball of matter that has never `lit up' to become a Sun. But don't underestimate it: Nemesis is still as big as several Jupiters, enough to dwarf the Earth many, many times.

Interestingly, the Nemesis theory wasn't proposed by astronomers -- but by paleontologists studying our planet's prehistoric past.

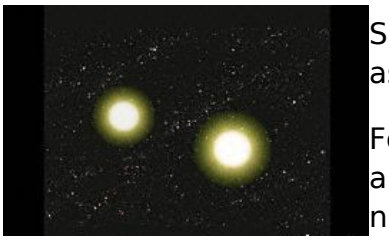
Oh yes, we all know the dinosaurs were smoked by a huge piece of space debris the size of San Francisco slamming into our planet some 65 million years ago. But there's more. Around 35 million years ago, another meteoric bombardment hit our planet. Not to mention the cataclysmic, yet unexplained events that led to the extinction of almost all life on Earth 251 million years ago. In fact, the path of evolution is littered with mass extinctions.

In 1984 it suddenly dawned on two University of Chicago paleontologists, David Raup and John Sepkoski, that these extinctions actually show a certain pattern. Raup and Sepkoski had put together a detailed list of sea life that had become extinct during the past 250 million years, containing more than 3,500 different species. And there it was: according to the lists, our planet faces a period of death and destruction every 26 to 30 million years.

In the years that followed, scientists from all over the world speculated on the cause of this bizarre extinction pattern. Did the gravitational pull of huge planets like Jupiter and Saturn have something to do with it? Or was there a mysterious `Planet X' somewhere out there, orbiting our solar system and paying us a visit every 26 to 30 million years? Then, in the mother of all science magazines **Nature**, two groups of researchers independently of each other came up with the twin Sun-idea. It was 1984, and the Nemesis hypothesis was born.

Although a lot of astronomers at first thought the Nemesis idea was a joke, the hypothesis also attracted the attention of a considerable number of respected scholars. One group of researchers, led by the Louisiana-based astrophysicist Daniel Whitmore, even claimed Nemesis might be a black hole, a super-dense dead sun that eats all matter and light it encounters.

Meanwhile, Walter Alvarez -- the guy who came up with the dinosaur extinction theory -- studied a number of impact craters on earth. His conclusion: indeed, once every 26 to 30 million years, something starts throwing an awful lot of rocks at our planet. Other researchers -- among whom the `inventor' of Nemesis Muller himself -- studied the age of impact craters on the moon, and reached similar conclusions.



So, is Nemesis for real? In spite of all the evidence, most astronomers don't think so.

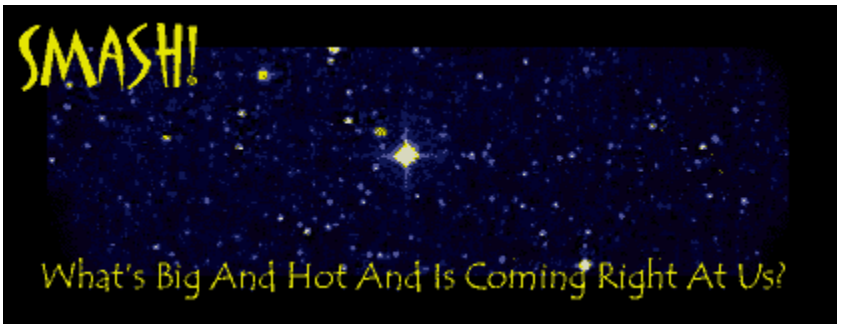
For one thing, Nemesis has never been spotted. Okay, it's dark and relatively small. But still, we should have noticed **something**, studying the motion of the Sun. If something really orbits the Sun, it tugs a little at the Sun, no matter how far away it is. And no one has ever noticed any unexplained wobbling of the star we call Sun.

Besides, the `extinction periods' themselves are heavily disputed. The fossil record dates back about four billion years and is scattered with mass extinctions. On the whole, there's just no real time pattern there.

Still, in the beginning of 2000 the Nemesis theory quite unexpectedly gained some new ground, when a team of distinguished US astronomers of Berkeley and Princeton calculated that Nemesis, if it exists, indeed should be a brown dwarf. Meanwhile, John Matese of the University of Louisiana studied the orbits of 82 comets in the Oort Cloud. According to Matese, their orbits had some elements in common that could only be explained if the comets had been influenced by the gravitational pull of an object several times the size of Jupiter.

So don't write off Nemesis yet. The case on the Sun's evil brother still isn't closed. Luckily, we have plenty of time to learn more about it. The Death Star is due to arrive a royal thirteen million years from now.

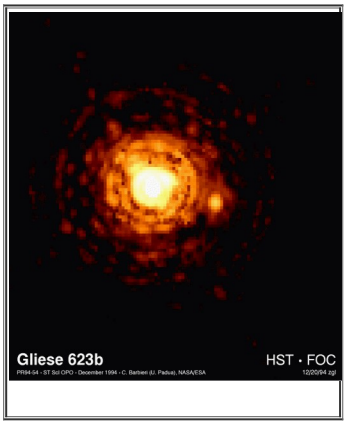
GLIESE 710 – AD 1,400,000



If you like to watch the stars, watch this: that faint, little white spot in the constellation of Ophiuchus. You don't see it? Don't worry: it will get bigger over time. For actually, it's a star that's coming straight at us.

For an object that could one day smash our world to bits, the star has a pretty dull name: 'Gliese 710'. Most people probably have never heard of the thing. But that will change over time, as Gl-710 gets nearer. And nearer, and nearer. You see, Gliese 710 is rushing straight towards us, at the breathtaking speed of 50,400 kilometers per hour – almost fifty times the speed of sound.

Gliese 710 is a dull, red dwarf: a small, dim star. It only shines with four to five percent of the Sun's luminosity, while it's mass is only half that of the Sun. So why worry, you ask? Hold on: it's still a STAR we're talking about here! And that's not the kind of object you want to find in your backyard in the morning: Gliese 710 is more than fifty times as big as the Earth, and more than 100,000 times as massive. Oh, and it BURNS!

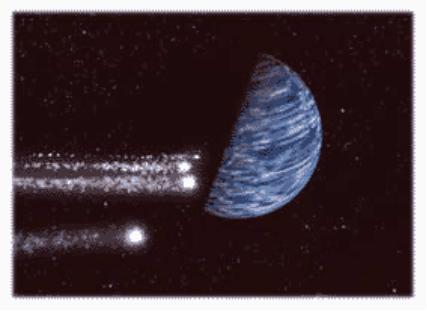


Gladly, we'll have 1,4 million years before catastrophe strikes. What's more, Gl-710 is destined to pass us at 40,000 times the distance between Earth and the Sun, in what you could call a complete miss. But wait - there's something else.

Most likely the Death Star will mess up the pile of cosmic debris called the Oort Cloud a bit, and start throwing planet-sized chunks of rock at us. For tens of thousands of years in a row, we'd have to shelter for incoming comets. Our planet could get hit, or an exploding comet could block the Sun and trigger a devastating Ice Age – much like the ominous, hypothetical space body called Nemesis is held responsible for at least ten extinctions on our world.

Gladly, there’s also a possibility Gl-710 will do nothing nasty in particular. You see: incoming stars from many light years away are always a bit hard to predict. So in the end, Death Star may simply miss our Solar System completely.

Then again, of course it could also be the other way around.Perhaps the calculations are wrong for the worse – and Gl-710 smashes into our Solar System directly. The dreaded thing would start gobbling up planets, or kick our poor Earth away into deep space. We would be incinerated, or deep frozen, or if we’re really having a bad day, both.



And that's not everything. Gliese 710 is not the only star that’s coming our way. During the next million years, at least eight stars will come closer to us than our current closest neighbor, Proxima Centauri at 4,3 light years. One of them, a red dwarf called Barnard’s Star, will arrive in only 10,000 years time. After that, a massive twin star system called Alpha Cen A/B will come knocking at our door. Calculations show the system is massive enough to give the Oort Cloud a good stir. Better keep those hard hats within reach, folks!

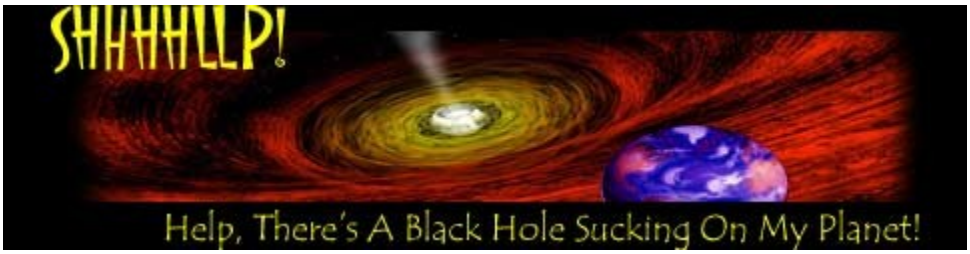
And how about this? There’s always the remote possibility Gl-710 or one of the other incoming stars is surrounded by planets. And that some of these planets are inhabited worlds. As you can read elsewhere on this site, the chances that this life is intelligent are vanishingly small. But for arguments sake: suppose it is. What would it do if it found us on their way? What would *you* do?

As every science fiction freak can tell you: it’s probably not a good idea to be a stand in the way for some kind of Klingon civilization.

LINKS OUT

http://www.space.com/scienceastronomy/solarsystem/death_of_earth_000224.html

BLACK HOLES – any day now



Watch it! We're not aware of it now, but there may be a killer on the loose. Chances are that our planet is on the menu of a real Black Hole.

We won't notice it right away. You see, the trouble with Black Holes is that they are, well, kind of black. You don't really see them -- until they suddenly knock on our door.

And `knocking' is an understatement. Suddenly, we'll notice a weird disturbance of the outer parts of our solar system. The cosmic debris that makes up the Oort Cloud -- the outer edge of our solar system -- starts acting strange. The orbits of the outer planets Pluto and Neptune might become disturbed. Out of nowhere, planets will change course.

Cosmologists will ring the alarm bell -- if they don't decide it's better no-one knows what's coming. But after a while, even amateur astronomers will notice there's something odd going on. For example, they might notice that one day, planets like Jupiter or Saturn are no longer there.

Oh boy, will that bring about some panic on Earth! A Black Hole, a real Black Hole is speeding through our solar system! Scientists on TV will bring the bad news: one year, two perhaps, but then it will all be over. Perhaps some politicians will make a feeble attempt to nuke the Black Hole. But that's so stupid. You can't blow up something that is not really an object -- but a hole.

After some time -- will it be years? months? -- the Black Hole finally closes in on our planet. Suddenly, our entire planet is lifted from its orbit around the Sun. In a tiny fraction of a second, it accelerates to the speed of light, and zooms off, destination Black Hole.

Once there, something highly unusual happens. The Earth suddenly stretches out, forming a sort of thread, with zero thickness (no, really!). In that shape, it will be sucked into total nothingness, as the Black Hole devours our planet with everything and everyone on it. There will be no explosions or woes of agony -- all that is sucked up too.

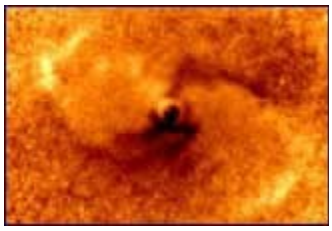
And that's not even the worst possibility. More likely, the Black Hole will pass our planet at some distance. It won't swallow the Earth. But it will definitely take a swing at the planet's orbit around the Sun. Like a giant catapult, it will kick away the Earth, off into deep space. Earth will become a lost planet, covered in coldness and darkness forever.

No need telling that on a planet like that, life is absolutely impossible. We may hold out for a while, clinging to all the technology we can think of, but after that we'll definitely die a horrible deep space death. No Sun is no heat -- but also, no plants, no plankton, no tidal forces and as a result, no climate, no atmosphere and no oxygen. Thank you very much, mr. Black Hole!

So, what is a Black Hole, really?

A Black Hole is, in essence, the corpse of what once was a star. When a star with at least five times the mass of our Sun runs out of fuel, it implodes. It's own gravity presses it together -- and presses it together some more, until there's nothing really left. What you have then is a Black Hole: a tiny speck of matter (well, matter isn't the right word, really), but with immense mass.

Because of that, Black Holes have an unimaginable gravity. So strong is their gravity, even light can't escape from it -- that's why the darn thing is called `Black Hole' in the first place (the term `Black Hole' was coined in 1969 by John Wheeler, who got tired of using the tongue twisting term `gravitationally collapsed stars' all the time).



Black Heart: Black Holes are believed to be at the center of each galaxy. They cannot be spotted directly, however; astronomers have to look around it, where they may see matter being sucked into the hole.

And the bad part is, no-one knows how big the threat is. There might be a Black Hole heading our way as we speak. We do know that every once and a while, another star pays our solar system a visit. So it's only common sense to assume we should sometimes bump into a dead star, too. A star, you would see that one coming. A Black Hole -- you wouldn't.

Now, if you're a devoted science fiction fan, perhaps you don't worry too much. There are all kind of great fantasy stories about what lies beneath the Black Hole (remember the 1979 Walt Disney-movie `The Black Hole'?)

And indeed, no-one really knows if a Black Hole isn't in fact some kind of gateway. It might lead to another part of the Universe, or even to an entirely different Universe. So falling into a Black Hole may be a fun thing to do after all.

Well, those sci-fi fans overlook one minor detail. Before `passing' the Black Hole, your body turns into a tail of spaghetti. Also, the atoms you are made of are ripped

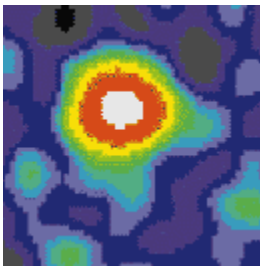
to pieces. So if it's Black Hole day, bear this in mind: once you get to the other side -- if there is one -- you won't be sending any postcards home.

GAMMA BURSTS – any day now

Some call it the main cause of death for life in the Universe. Right or wrong, we should consider ourselves lucky that so far, the most violent natural phenomenon of all has left our planet alone. If it one day does strike, better say goodbye. We don't stand a chance against the infamous `gamma ray bursts' (GRBs).

It's like a lottery, really. Every day, somewhere in the Universe, there's a HUGE explosion. Within seconds, an amount of energy sets free that equals the amount of energy the Sun would emit in its **entire** lifetime. In fact, some of the blasts are bigger than the energy of all stars combined. No, you just DON'T want to be around when such an explosion occurs.

Strangely, the explosions are usually invisible to the human eye. You would need gamma ray vision to see them. We're talking **gamma ray bursts** here: cosmic super explosions that throw an awful amount of gamma- and X-radiation into the Galaxy.



The afterglow of a gamma ray burst

It was only recently scientists found out what gamma ray bursts really are. A GRB is what happens when a huge, dying star is eaten up from within by a black hole. One moment, you'll see a gigantic star, and the next moment, shhhhlllp!, it is gone, sucked up by a black hole. In those final moments, the black hole spews out a column of energy -- almost at light speed! That's why gamma ray bursts are often called 'the birth cries of black holes'. A less friendly, but more accurate, term would be that GRBs are belching black holes after they've eaten a star.

Gladly, until now these super-spectacular things only happened in distant galaxies, billions of light years away.

But then again, that could change. Heavy, rotating stars like the ones that cause gamma ray bursts exist in our part of the Galaxy, too. At least one is about to go pop: Eta Carinae, a beautiful, but dying star system in the southern constellation

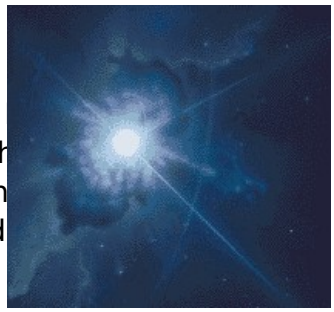
known as the Keyhole. Gladly, the burst won't hit us directly, since the axis of Eta Carinae is pointed away from us. But any day, we could stumble upon a dying star that IS aimed at us.

On a list of twenty phenomena that threaten life on Earth published by the popular science magazine Discover, gamma bursters come second, right after asteroid impacts. As Arthur C. Clarke once pointed out, gamma explosions may be the reason why we don't notice much of extraterrestrial life forms: long before an alien civilization would have come to the point of going out in a UFO to explore the galaxy, a gamma ray burst would have wiped it away.

If a gamma ray burst really does go flash somewhere in our cosmic neighborhood, the end of times would be really nasty. It will be like a Hiroshima bomb going off -- on every place on Earth at the same time!

At a distance of something like one thousand light years, the afterglow of the burst would light up as bright as the Sun. Moments later, our planet will be bathed in a HUGE load of super energetic gamma and X-rays. A fiery blast will set the atmosphere ablaze. Forests will burn, rivers and lakes will boil away and the side of the Earth facing the blast will be sterilized immediately.

And you won't be safe on the other side of the planet. A massive shockwave, much like the aftershock of a nuclear explosion, will sweep across the globe. A wall of fire will roast every living thing on Earth -- well, except a few fish, that is. The Gamma Ray Burst will reset evolution.



Even a blast occurring farther out in the Milky Way won't be good for our health. OK, so the burst is too far away to fry us. up our atmosphere. The energetic gamma rays will grind up th atmosphere is made of into separate molecules of nitrogen an atoms in turn will mop up the ozone layer, leaving us exposed radiation from the Sun.

And if that isn't enough to kill you, there will be the soot. High up in the atmosphere, the loose atoms will bind up into nitrogen dioxide, a brown, filthy gas that will blanket the Sun. We'll have a massive nuclear winter and die a horrible climate disaster death.

To make things worse, no one really knows how big the risks are. On the one hand, gamma ray bursts that damage our world are likely to happen once every 10 million years on average. That would mean our planet has survived many, many bursts in the prehistoric past.

On the other hand, it's hard to predict when the next GRB will hit us. Could be in million years time. Could be tomorrow.

ALIENS – any day now

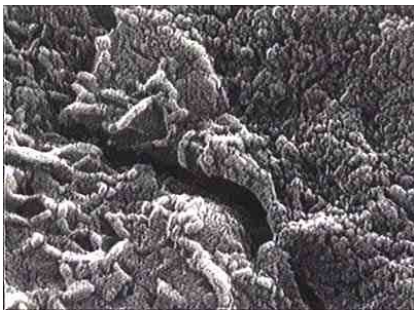
First, there's some kind of freakish UFO hovering over the planet. Then it's pow, blast, boom. And then? Then we're all dead.

Yeah, right, dead. What happened? A little while ago, some alien civilization decided Earthlings are a major pain in the ass. And now, they shot the Earth to bits with some kind of doomsday weapon out of hell. The planet incinerated, or evaporated, or was turned into a self-annihilating chunk of anti-matter -- whatever you think of. One little push on a button by a green hand, and gone we were.

But wait. First, you'll need alien life smart enough to go out in a space-ship and gun our planet to custard powder. And of course, some kind of motive would be nice. A disagreement over something, to say the very least.

So, how about the existence of alien life? Without letting fantasy take over, most serious scientists agree by now that there should be some kind of life somewhere out there. And they don't say this because they have seen to many shows of the X-Files.

First, the Universe of course is, to put it mildly, rather big. And there's the **cosmological principle**: no matter what chunk of universe you take, it will always be roughly the same stuff, with galaxies and stars and planets around those stars. There's plenty of evidence for this. Astronomers have spotted quite a lot of **exoplanets**: planets around distant stars. And if there are planets everywhere, surely planets that are inhabited can't be so unique, you may argue.



Fossils from Mars? The Mars comet ALH84001 has attracted new attention, now that new evidence seems to suggest the odd microscopic structures on its surface may indeed be the remnants of bacteria from outer space.

And then there's this. Life on our planet suggests that the existence of life is no big deal. Life is way older than we always thought: some 4 billion years. This means that life popped into existence almost immediately after the Earth stopped being plowed over by comets, volcanic eruptions and cosmic radiation. So life is something that very easily emerges.

But. Yes, there's a `but'.

When scientists say `life', they usually mean: unicellular life, bacteria. A wide-spread misconception about nature is that evolution is about going from single-celled bacteria to more complex beings. It is not!

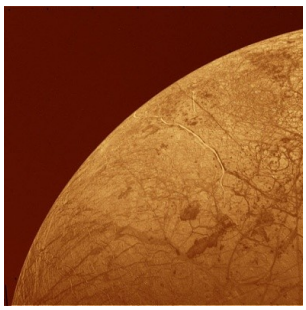
The sole thing that makes evolution tick is diversity. More evolution means more diversity among those invisible, tiny bacteria that make up more than ninety percent of all life forms on Earth. In the first place, evolution means more species of bacteria. Ducks, bumblebees, fig trees and humans are more likely a side-effect, an odd waste product of natural selection.

Even more humbling, intelligence is a very rare phenomenon among animals. Out of **fifty million** species on Earth, only one knows what the Internet is. And to be sure, if that big comet didn't wipe out the dinosaurs 65 million years ago, thinking apes calling themselves men wouldn't even have existed! In nature, intelligence is so fucking rare.

You're not amused? Well, here's some more. Intelligence isn't even really a good tool for playing Darwin's `survival of the fittest'. In fact, the human race almost got extinct right after learning how to walk on two legs, when our species was diminished by hunger and drought to a slim total of some ten thousands!

It's very obvious intelligence has a lot of evolutionary downsides. Because of our ridiculous large brains, we are super-vulnerable to cold, heat or wounding. Because of our huge heads, we are the species that has most trouble with being born.

And there's more. Try wrestling with a lion. Try catching a rabbit, using only your bare hands. Try surviving in a forest. Just peel away all `culture', and you'll see what humanity really is: a rather clumsy, weak and ill-equipped species with a ridiculously big head.

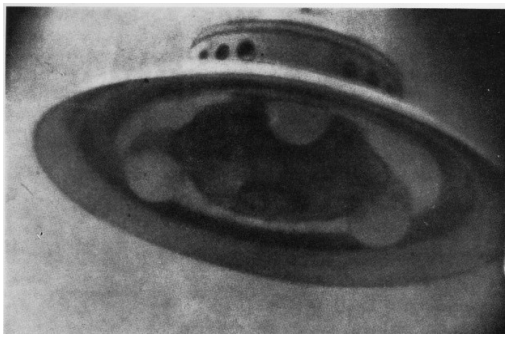


Life? If there is alien life out there, it may very well be hidden under the icy surface of Europa, the second moon of Jupiter. The satellite Europa is believed to have a liquid water ocean deep under its icy crust. The gravitational pull of Jupiter adds the energy to keep this water liquid - and, who knows, to breed some kind of alien sea life?

So, to wrap things up: ET is very likely out there. But it's very **unlikely** ET has a light sword, a space ship or an index finger that lights up in the dark. ET is more likely a bacteria -- or at its best, a multicellular organism with no particular intelligence at all.

Hey, and besides. Just suppose there is, in spite of all the problems, intelligent life out there somewhere? Would we be at risk of being killed by them?

Surely, they'd have to be able to travel around. That's not an easy one, although science-fiction freaks carelessly say that such a civilization undoubtedly will use `worm-holes' for inter-dimensional travels. Or warp-drive, or teleportation. The cold fact, however, is that such things may well appear to be just **impossible** by physical law. It is so very easy to say: `Well, they're ahead of us, so they must have come up with something.'



UFO's?

Oh boy, UFO's. Millions actually believe in them. Exit Mundi doesn't. At least not until one of those little gray characters actually shows up on The Late Show. For one thing, please take a good look at the picture on the left. The picture, taken in the sixties, is one of the most `convincing' UFO photo's ever, UFO-freaks claim. Well, if so, why then does this particular UFO look so hopelessly outdated? It reminds of sixties cars and sixties sci-fi movies with its round windows and its totally un-aerodynamic, uncool shape -- not of some highly advanced civilization.

Even then, the aliens have to find us. That too is a tough one. The Universe is so big. And our planet is only a tiny speck of dust in the endless nothingness. Okay, we send out signals into space, from our satellites, radio's and TV-sets. But our transmissions have a tiny reach in the vastness of the cosmos.

And even within reach of Earth transmissions, an alien would have to listen extremely closely to pick up our faded-away signal. Let alone the problem of which frequency to choose. Or the problem that an alien might prefer a very different technique than `radio signals'.

Okay, okay. Against all odds, our hypothetical alien has overcome all these difficulties, and has finally found us. What's up next?

Nothing much, probably. The aliens may want to study us -- a civilization that builds spaceships and has found out how worm holes work definitely is in it for science. They would study us in much the same way we study the microbes we'll undoubtedly find on Mars or Europa.

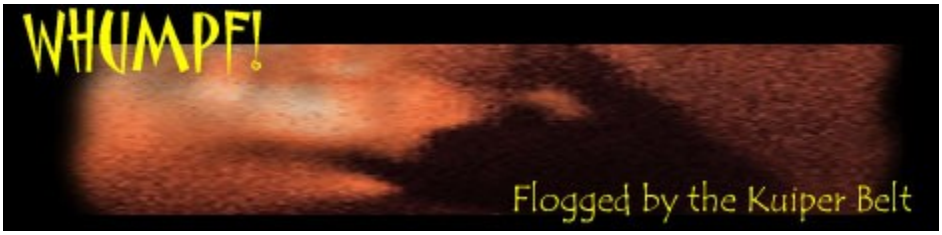
Yeah, some **Independence Day**-fans might grumble. But they might also be here to colonize our planet, to steal our mineral goodies!

O yeah, sure. What nonsense. Do you really think a civilization that builds intergalactic spaceships and opens worm holes doesn't know how to solve problems like shortage of minerals in some technical way? They'd have to be a race of real dumb-ass aliens, if you ask me.

Beware of the Tripods!

Yes - we did see War of the Worlds.
Nice movie! But a movie it is. And we found the script somewhat, well, unrealistic. Here you have these aliens who have been studying the Earth for millions of years - and they overlooked bringing a doctor, or some kind of vaccine? Aw, really...
And there are more incredible things. For one thing, if you're a highly advanced creature looking to rid the world of humans, going out in your tripod seems like the dumbest thing to do. You'll have to shoot 6 billion humans! To an alien, that might be a fun thing to do, but there are obviously more efficient ways to rid the planet of humans.
The least they could have done is visit Exit Mundi!

KUIPER BELT – any day now



Although today is a cloudless summer day, the sun doesn't really shine as bright as it ought to. In fact, it's freezing cold down here on Earth. Uh-oh, the Kuiper Belt is at it again!

The Kuiper Belt is a huge disc of cosmic rock, that stretches out across the Universe somewhere between Neptune and Pluto. It is a leftover of the formation of the planets in our solar system. Cosmologist John Gribbin once called its discovery `one of the most dramatic astronomical findings of the 1990s'. For here, lurking right behind our back door, is a real Armageddon in the making.

Okay, so Neptune and Pluto, that's a long way away. The Kuiper Belt sits some forty to fifty times further out from the Sun than we do. But as computer simulations show, that might change. From time to time, the gravity of the outer planets will disturb the Belt, and sling a huge piece of rock straight into the inner solar system. Doom will come rushing straight towards us.

One problem is, we will hardly see it coming. The Kuiper Belt was discovered very late, partly because the comets it contains move slowly, and partly because it isn't made of solid pieces of rock. Most of the supercomets in the Kuiper Belt are `dirty snowballs' made of dust and ice, making them incredibly hard to detect with modern equipment.

Calculations show that there are at least 70,000 of these icy objects out there. And most of them are really big: the first that was detected -- an object dubbed `QB1' -- is about two hundred kilometers across. By comparison: the killer meteor that wiped out the dinosaurs and almost all life on earth some 65 million years ago was only ten kilometers across, twenty times as small as QB1. Some experts argue that Pluto and its moon Charon themselves are to be considered as part of the Kuiper Belt.

Gladly, the chances of such a super comet actually hitting the Earth are vanishingly small. The Earth is only a tiny pea in the vastness of the Universe, and is `protected' against incoming comets by the gravitational fields of other planets.

But then again, full impact is not the biggest threat the Kuiper Belt poses. As a Kuiper Belt comet comes rushing in, its icy surface will heat up. Eventually, when it

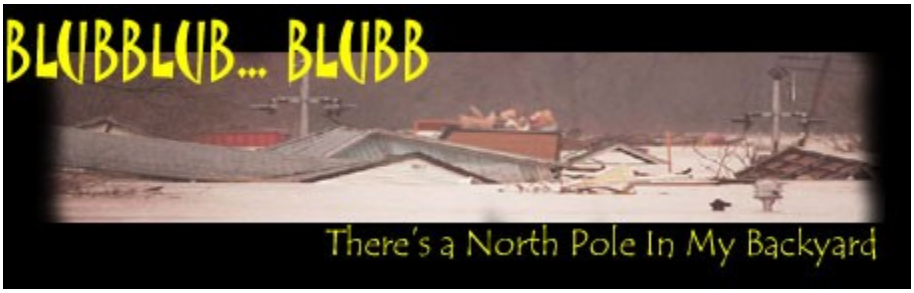
comes too close to the Sun, it will explode. Its remains will be scattered all over the place. The dust will be attracted by the Sun's gravity, and clot together into a temporary ring of dust around the Sun. The debris will block some of the Sun's heat. And when that happens, we're in big, big trouble.

Temperatures on Earth will drop rapidly. The dust will trigger an Ice Age on Earth. Oh, and then there's the realistic danger our planet is hit by comets after all, with all those chunks of comet debris flying around in our part of the solar system.

Obviously, what grim destiny exactly awaits us depends on a lot of things. Many of them are determined by pure chance. One particular nasty Kuiper Belt scenario involves an all-out Ice Age, in which so much of the Sun's heat is blocked that the entire Earth turns into a barren, frozen planet. The Earth's climate thermostat (being the intricate interplay between oceans, land, vegetation and algae) would be severely deregulated. It would take the planet hundreds of thousands, if not millions of years to recover. Of course, the chances of survival would be slim in a stone-cold world with frozen oceans and no soil to grow your food on.

But here's the good news: with or without humans, the planet eventually will survive. It did so before. In the Pre-Cambrian age (more than 600 million years ago), the Earth survived several super Ice Ages. But then again, in those days the most complicated life forms on the planet were tiny shrimps and snails, crawling around in the deepest depths of the ocean.

ALIGNMENT – 9/11/2040



Always wanted to visit the South Pole? Well, here's the good news: soon, the South Pole could visit you. It's Thursday the 9th of September 2040, and we're in for a big surprise.

Thursday 9/11/2040 has inspired a broad range of researchers and publicists to preach doom and destruction. And no wonder. In the early morning hours of this particular Thursday, a rare cosmological event will take place. All visible planets -- Mars, Saturn, Jupiter, Mercury and Venus -- will align with both the Sun and the Moon. They will be in an exact row.

You won't be able to see much of it, since the brightness of the Sun will make the view on everything else impossible. But according to the doomsayers, we will definitely notice something. Just picture this: there's SEVEN huge objects in the sky, tugging at our tiny planet with their combined gravities. This will cause the Earth's axis to tilt, moving Middle Africa to the North Pole and the icy Antarctic to the equator.

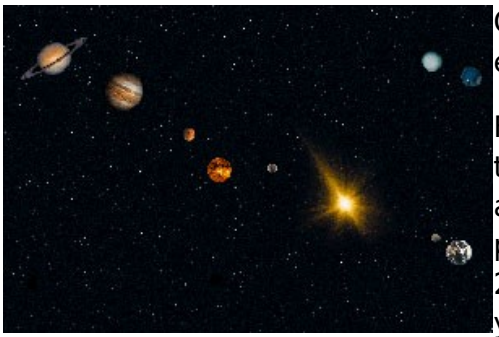
It will be quite a disaster. Rapidly, the ice caps of the poles will melt, causing massive floods and huge tsunamis all over the world. Millions will drown, entire continents will be flooded. Not to mention the faith of those poor Africans and Latin Americans, who will suddenly find themselves living on one of the poles!

And that's just the beginning. The tidal forces of the seven heavenly bodies combined will trigger earthquakes bigger than we've ever had. Also, there will be volcanoes erupting everywhere. If you don't drown, chances are you're crushed by a collapsing building or covered in lava. Well, if that isn't what you call `the end of the world', what is?

Just wait -- it could get even worse. Perhaps our planet will be torn apart, some doomsayers claim. The gravitational forces may literally rip our planet in two, cleaving it like a cabbage head. It would be an incredible mess, with little chance of survival.

Another unpleasant possibility is that our planet is pulled out of orbit, and moved into a wider one. It would become so cold on earth, it wouldn't matter anymore if you were on the South Pole or not. Everything would freeze, and our atmosphere would vanish, making life on Earth impossible.

The gruesome scenario of September 2040 has been laid down in detail by many publicists, among others by Richard Noone in his book `Ice: The Ultimate Disaster'. According to Noone, the planets haven't aligned in many thousands of years. Last time it happened, says Noone, it caused Noah's flood. And as you know, a LOT of people had trouble facing that flood.



Oh, but it also could turn out quite differently. For example, nothing at all might happen.

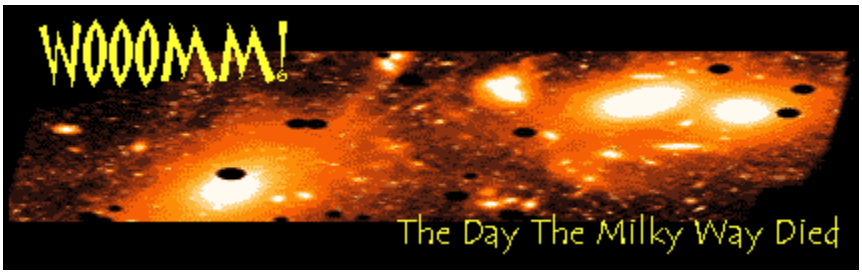
For one thing, Noone is dead wrong in claiming that the alignment is rare. In the 1960s, a Belgium astronomer named Jean Meeus calculated that precisely the same event as the one of September 2040 took place no less than nine times since the year 1000 AD. For example, a seven-body alignment took place on February 5th, 1962. And as far as we know, no poles melted away that day, nor were there any earthquakes or volcanic eruptions.

Although Saturn and Jupiter are BIG planets, they are simply too far away to do us any harm. Their gravitational pull, even if combined, is only a tiny fraction of the gravitational pull the Sun and the Moon exert on our planet. And as you know, these two objects don't kick the Earth's axis over. The only thing we do notice, is the changing of the tides.

And if you STILL are in doubt, there's this. In fact, we have been lying to you a bit. Richard Noone didn't write a book about 2040. His scenario of quandary and blight dealt with another date: the 5th of May 2000. On that day, the super alignment took place, too. And as you should be able to remember, nothing happened on that day either.

So, doomsday cancelled? Well, just wait and see. You can safely assume that when 2040 comes around, there will be some new Richard Noones around, advising us to put on scuba.

ANDROMEDA – AD 2 BILLION YRS



Worried about getting hit by a meteorite? Aw, that’s so boring. Just wait -- a few more billions of years, and we’ll have an entire GALAXY falling down on us!

‘Andromeda’ is the name of the incoming star system. And believe us, it’s not the sort of thing you easily shoot away with some rocket missiles. Think of a vast armada of some 300 billion massive stars and hundreds of billions of planets, hurtling towards us at the breathtaking speed of 300 kilometers per second. The Andromeda Galaxy is big enough to literally gulp down our entire Milky Way. It is HUGE, measuring some 150,000 light years across.

For the last billions of years, we’ve been sitting in a rather dull suburb of the Milky Way, with only an occasional incoming meteorite to break the boring routine of everyday life. But the Andromeda Galaxy should change all of this completely. Like a circular saw, it will cut into the Milky Way. It will literally rip it apart.

It will be quite a stir. Think of stars and planets flying about. Think of vast cosmic explosions. Think of gravitational ripples ploughing through your body, think of blasts of radiation flogging your planet. There will be choking, cosmic gas clouds everywhere, and supernova's going off, and black holes roaming around. Everywhere you look, you'll see explosions and violence. The sky will be `like a Christmas tree lighting up', as one researcher put it.

And then, amidst all this cosmic rumble-a-bumble, there's us. It is hard to tell what exactly awaits our tiny, little world, should it still exist. Perhaps our planet is swallowed by a black hole. Perhaps it gets incinerated in a supernova, or fried by a gamma ray burst. Or perhaps it'll be squashed by something far more mundane, like a rogue meteorite, or a simple, incoming sun-like object. There won't be any insurance guys left to make up for the damage, that's for sure.

Exit Milky Way: Artist's impression of our poor Milky Way, cleaved by Andromeda. In reality, both galaxies will be ripped apart (see below).

Luckily, the bad stuff won't happen overnight. For starters, the Andromeda Galaxy is still very far away. Although Andromeda is already about six times larger than the full moon in the night sky (but much fainter), it should take something like 2 to 3 billion years before it comes crashing in. That should give us some head start to come up with something.

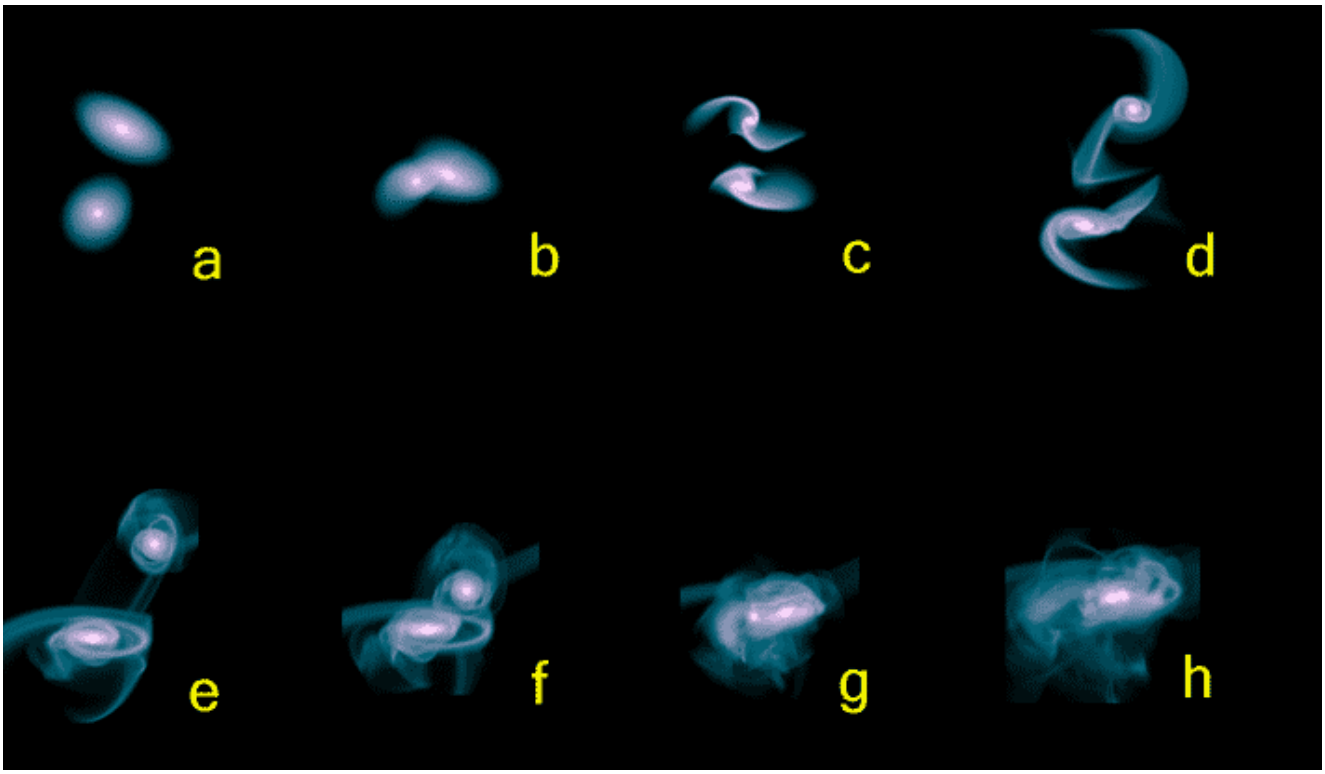
And even then, disaster will unfold only slowly. The distances in the Universe are simply too large for it to happen all at once. There will be many spectacular space explosions and crashes and outbursts around -- but only every now and then: say, once every so many thousands of years. All in all, it should take the Andromeda Galaxy something like 1 billion years to smash up our Milky Way completely.

And after that? Lo and behold, there's a happy ending. Sort of.

For our planet and our Milky Way may go down, but out of the remains comes a brand new galaxy! It should be an elliptical star system, much like the one we're living in now -- but much, much larger. There will even be lots of new, young stars around. They will light up in the dense parts of the space clouds.

That's why scientists aren't too gloomy. In general, they consider colliding galaxies as something beautiful. When galaxies crash into each other, it's like they're mating: out of the mayhem arises a youthful, brand new galaxy. And astronomers know what they're talking about: they have studied several well-known colliding galaxies already, peeking through their telescopes.

So when Andromeda starts falling, just bear in mind: you might die -- but it'll be a fun thing to see!



Andromeda Mishap: A computer model study of the collision of the Milky Way (the smaller galaxy) with Andromeda reveals how Andromeda plows into our star system like a saw (a-b), how both galaxies unravel (c-e) and finally merge again, forming a new galaxy (h). (Images with permission John Dubinski, University of Toronto)

LINKS OUT:

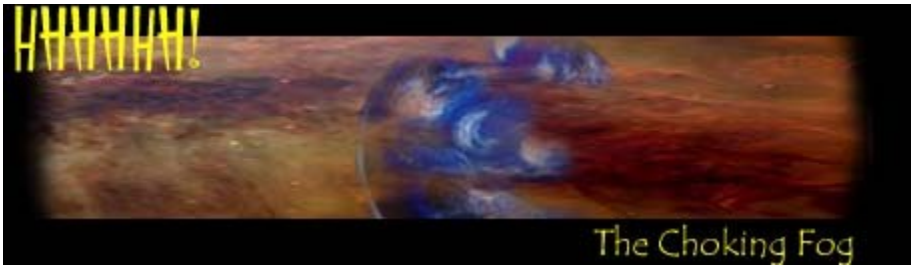
Gravitas: Portraits of a Universe in Motion

The Merger of the Milky Way and Andromeda Galaxies

Space.com: Simulating the Fate of the Milky Way

Andromeda, The Nearest Spiral Galaxy

SPACE CLOUDS – AD 100,000 +



The Universe is a dangerous place. There are black holes, and sudden explosions, and meteors flying around everywhere. But hey, that's not all. Something so ordinary like a cloud may one day do us in as well.

Of course, the Doomsday Cloud that will bring about the end of the world is quite different from those puny pieces of wadding you see up in the sky every day. Our cloud of doom is a bit bigger than that. It would take our planet something like**one million years** to pass through it. That's why scientists refer to the thing as a **`Giant Molecular Cloud'** - `giant' being no understatement for a cloud that's several light years across.

In the emptiness of the Cosmos, Giant Molecular Clouds are nothing special. Giant Molecular Clouds are, in fact, stars in the making. First, there's a cosmic cloud of dust and gas; next, gravity presses the cloud together -- and finally, there's a bunch of stars lighting up. In fact, our own Sun started out as a cosmic cloud, too.

But what harm can something so utterly boring like a cloud really do?, you may ask. Well, for one thing, space clouds have the rather nasty habit of choking the life out of every planet they swallow. According to some scientists, it was a cosmic cloud, and not a comet, that did in those poor old dinosaurs!

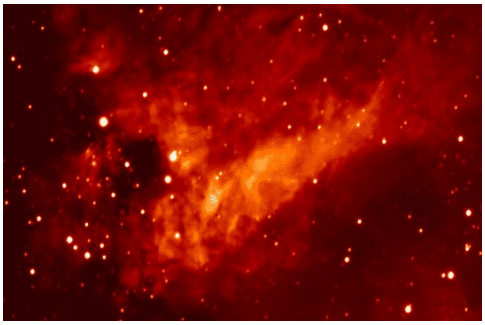
Giant Molecular Clouds have a reputation for messing up the atmosphere of each Earth-like planet they encounter. When our planet passes one, dust from the GMC will block the Sun. The Sun would become a vague blot of light in the sky. In no time, a spine chilling Ice Age would break out.

Oh, big deal, so you turn up the heating. But wait -- that was just the beginning.

Apart from dust, Giant Molecular Clouds typically consist of huge amounts of hydrogen. Loads of it would penetrate our atmosphere. Once there, the hydrogen would start mopping up oxygen atoms, combining them into water. Surely, this would bring about a lot of rain (as you might expect from a cloud). But what's

worse, with the planet's oxygen level dropping, breathing would become hard -- if not impossible.

And the Doomsday Cloud isn't finished yet. Since the thing consists of soot and dust, it has gravity. Consequently, it will attract millions and millions of cosmic rocks and meteorites from the outer regions of the solar system. Planet sized chunks of stone and ice will come flying in from all directions. Some will explode and block the Sun even more; others will just hang around a bit or, well, impact on Earth.



Heavy weather: Cosmic clouds, or nebulae, are beautiful. Still, they mean trouble for inhabited planets that pass them.

So basically, GMCs bring about all kinds of apocalyptic events at once. Meteors, Ice Ages, Nuclear Winters, oxygen shortage, floods, volcanoes -- you name it, it's all there. Once smothered in a space cloud, we would find our planet harassed by every weird and violent natural phenomenon you can think of. For hundreds of thousands of years in a row, Earth would be a complete mess, a mayhem of meteoric impacts, blackened Suns, climate shifts and cataclysmic floods not unlike what Saint John wrote about in his biblical book The Apocalypse.

Gladly, we should see a cloud like this coming. And as far as Exit Mundi knows, the cosmic weather forecast looks quite good, predicting a cloudless Universe for many hundreds of thousands of years to come.

On the other hand, it doesn't really help that one day, our solar system may indeed run into a GMC. When it does, better prepare for the worst. Space weather would be BAD for a million of years or so. That's plenty of time to rid our planet of all things bigger than a microbe.

Chaos Cloud!

What is ten million miles wide, is made of burning acid, has a black hole for a heart -- and is hurtling towards us at near light speed?

It is the 'chaos cloud', my friends. This infamous bulb of misery is due to arrive on June 1st, 2014. And it merciless dissolves everything it encounters: comets, planets, even entire stars. Well, or so they say.

If you have never heard of the chaos cloud, don't worry. Neither had we. That was, until the object popped up on Yahoo news -- in the subdirectory 'entertainment', of all places. According to the news clipping, the cloud was

discovered on April 6th by NASA-scientists working with the Chandra X-Ray Observatory. Upon discovery, NASA decided to keep it a secret. Or so at least claims one dr. Albert Sherwinski, a Cambridge based astrophysicist.

Of course, the news is fake. It's a joke. It originally appeared in the magazine Weekly World News, a magazine full of pranks and fake news. There, it is listed among headlines like 'Scientists find women's asking-for-directions gene' and 'Nuclear rocket fired at UFO'.

To be sure, we ran a few checks. Lo and behold: there is no astrophysicist by the name of Albert Sherwinski. What's more, we should see the cloud with the naked eye by now (and we don't). And oh, a minor detail: in space, burning acid clouds revolving around black holes simply don't exist.

SUN BURNOUT – AD 5 BILLION YRS

Who said the Sun will shine tomorrow? Here's the bad news: one day, the Sun will NOT shine anymore. Eventually, the Sun will die. It will be a beautiful thing to see. But there's a bit of a problem: long before, the dying Sun will simply have swallowed the earth.

In case you didn't know, the Sun is in fact a huge nuclear power plant. It runs on hydrogen. The Sun transfers hydrogen atoms into helium by nuclear fusion. It's nothing like the puny hydrogen bombs humanity finds so impressive. Each second, no less than 400 million tons of hydrogen goes boom.

Unfortunately, the amount of fuel inside the Sun is limited. You can't see it, but in fact, that huge light bulb in the sky we call `Sun'  shrinks and cools down a tiny little bit every second. The Sun is `middle aged'. In another 5,000 million years, it will run out of hydrogen.

Long before, we will notice the consequences. On the one hand, the Sun will get brighter and warmer. On the other hand, as the Sun shrinks and becomes less

heavy, its gravitational pull on the Earth will loosen. Consequently, the orbit of our planet and all other planets in the solar system will widen.

Okay, so an earthly year will be several weeks longer. But don't mistake, there's a downside here. It will get colder. And not just a little bit. Within `only' several billions of years, Earth will become an icy, permafrost planet, where it will be hard to survive.

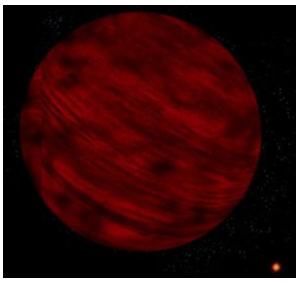
Well, we're still lucky, really. When the Sun eventually runs out of hydrogen, the nuclear reactions inside the Sun's core will stop. There will be no explosive force pushing outwards from the heart of the Sun anymore. The Sun will collapse, pressed together by its own gravity.

Subsequently, temperatures inside the Sun will rise even more. And, lucky we, there will be another nuclear reaction sparking off. The Sun will start fusing helium into carbon and hydrogen this time. KABOOM! This will prevent the Sun from collapsing any further. Finally, we will have warmth again.

But wait, we're in trouble. A nuclear power plant that runs on helium gives off a hell of a lot more energy and heat than one run on hydrogen. The new, immense power of the Sun's core will literally blow up the Sun. The Sun will grow, eating up several planets: first Mercury, then Venus. And next on the menu, yes, Earth.

The absorbing 1961 movie *The Day The Earth Caught Fire* gives a pretty good picture of what it will be like. Sure, it will become quite hot. Rivers will evaporate, causing dense, hot fogs. The polar ice will melt, causing oceans to rise and entire countries to flood. But then, the sea will evaporate as well. Long before the solar surface reaches our planet, we will simply be barbecued to death. Sadly, there is no happy ending. Eventually, Earth will be swallowed by the growing Sun. Our planet will burn up in its ultra hot outer layers.

Of course, we still have some 5,000 million years to come up with a solution for this nasty problem. For one thing, we might evacuate, or even find a way to move our entire planet away from the Sun. But even then, it's highly unlikely we will enjoy the Sun as much as we once did. Since the Sun has expanded so much, its outer parts will cool down. The Sun's surface will become cool, deep red. It will be a **Red Giant** -- `giant' being just the right name for an object that just ate up our planet.



So there we are in our spaceship or wherever we are, glancing back at our red giant Sun. Will that be it? No, it won't. Even the helium-into-carbon reaction doesn't last forever. Eventually, after another 100 million years or so, the Sun runs out of helium as well. The nuclear reactions will stop again, and gravity will take over once more. The Sun's core will collapse further.

Red Giant: cooler than the Sun, and much, much bigger

But this time, a dramatic change will occur. The Sun simply won't have enough gravitational strength to hold itself together anymore. The Sun's outer layers will be pushed off into space. In other words: the Sun will explode.

There will be a big nebula of super hot solar gas, flinging off in all directions. A beautiful sight, but not for us poor things. For many millions of years in a row, it will be like we're on the grill of a barbecue once more -- spaceship or no spaceship. And there will be radiation. Lots of it.

Okay, so we decide to keep it cool and move our spaceship further away from the dying Sun.

Still, even that won't be it. After the solar gasses and all the radiation have passed by, we will find that our vexed Sun has become a **White Dwarf**: a tiny, insignificant dot in the sky, still hot, but since there's no longer any nuclear reactions going on inside, cooling down fast.

Should we move our spaceship back to the Sun to catch some warmth? Well, we'd better not. For one thing, the gravity of our deceased Sun will be way too big to cope with. White dwarfs are incredibly dense. Although our ex-Sun will only have the size of the Earth, it will still have the mass of a star. A cubic centimeter may weigh several tons. So, by the time we'd reach a distance where it's warm and comfortable, our spaceship would simply crash into it.

And, oh well, what's the point in visiting White Dwarfs anyway?In the end -- more millions of years later -- the Sun will be cooled down so much, it will no longer give off any warmth at all. It will be a dull, extinguished object called a **Black Dwarf**.

Bye-bye, beautiful summer!

LINKS OUT:

http://www.astronomytoday.com/astronomy/sun.html

http://www.space.com/scienceastronomy/solarsystem/death_of_earth_000224.html

PAPER SOURCES:

"The Sun". In: New Scientist, 21 June 2003

"Fiery Future for the Planet". In: New Scientist, 2 April 1994

"Hell on Earth". In: New Scientist, 6 December 2003

BIG CRUNCH – AD 20 TRILLION YRS

Picture this: inside a cup of hot tea, a ghostlike shadow slowly takes shape, and then -- pop, out of nowhere there's a lump of sugar. It's only one of many oddities to be discovered when time starts running backwards. Weirder still, physicists agree that one day in the future, this might really happen, when the Universe displays the freakish burp of nature known as the Big Crunch.

What goes up must come down. With that thought in mind, the entire Universe might one day decide to shrink. And shrink, and shrink, and shrink. Until there's nothing left.

The Universe began some ten billion years ago, with the Big Bang. Out of nothing, a bulb of tremendous energy set free. Matter didn't exist. The only thing there was, was intense heat, and particles.

Outside the bulb was nothing. No time, no space -- as a matter of fact, not even a place where the word `nothing' would have any meaning. To ask what was `before' the Big Bang or what is `outside' the Universe is a meaningless question. It would be like asking what continent is south of the South Pole, or what Bill Gates did before he was born.

But the Universe expanded, at immense speed. It began to cool down, and matter slowly started to take shape. After 100,000 years, the first atoms formed. After 1,000,000 years, the first star flickered up. After 3,000 million years, a small star

that later would be called `Sun' was born. And another 5,000 million years later, an astrophysicist named Edwin Hubble would prove there was such a thing as a `Big Bang' in the first place.

Well, the Universe is still expanding, and cooling down. Time ticks. At least, that's what we experience from our point of view.

Time as we experience it is governed by **entropy**: the natural tendency of things to go into a more chaotic, less energetic state. That sounds more difficult than it really is. When you throw a coffee mug on the floor, it will break up into a chaotic configuration of splinters, while throwing a handful of splinters on the floor will not create a new a mug. When you put a lump of sugar into your tea, the sugar molecules want to mingle with the tea molecules, creating chaos. The only way to beat entropy is to invest energy -- for example; by gluing the splinters of the broken mug together one by one.

But in the end, entropy always wins. Mountains erode, the Universe cools, the Sun cools and will one day die, the Earth will eventually vanish, and all coffee mugs will some day be broken. Entropy is deepest, most profound driving force of the Universe. It defines time, ordering it to point towards what we call `the future'.

But then, out of the blue, something completely crazy happens. Suddenly, the Universe stops expanding. And it actually starts **shrinking** again, like a balloon losing air.

Some cosmologists assume this will indeed be the case. There may be too much mass in the Universe for the expansion to go on forever. The gravity of all matter in the Universe combined may cause the inflation of the Universe to slow down, come to a halt -- and after that, the Universe would start shrinking again.

This would have unimaginable consequences. In a Universe that's contracting, everything goes reverse. The arrow of time points backwards. Amazingly, entropy would go the other way around.

So there it is, the reverse-Universe. There are lumps of sugar coming out of nowhere and pieces of pottery coming together to form a coffee mug. Light will be mysteriously attracted to the Sun, and sucked into it. Atoms will want to form molecules as difficult as possible. Out of dust, mountains will form. Rivers will flow backwards. And you'll have to add cold to keep your cup of tea from becoming so hot it vaporizes and flies off.

But you won't. As a matter of fact, you won't do anything -- since you're probably not there anymore. Although some theorists believe that in a reverse-Universe, the

dead would rise again, living reversed lives until they vanish into nothing, it is unlikely this will happen.

For one thing, our bodies simply may not be apt to contracting universes. The biological mechanisms in our bodies are run by entropy. We need entropy like we need oxygen. No entropy, no life.

What's more, it will take a long, long time before shrinking day comes -- some estimates lead up to ten or twenty **trillion** years from now: 20,000,000,000,000,000 years. By that time, our Universe will have changed completely. Entropy will have caused stars to fade out and black holes to vaporize. Matter will be divided evenly across the Universe. It will have no particular reason to form stars and planets or humans living backwards lives. Matter will just clot together, making a denser and denser Universe.

Admittedly, it's all speculative business. But don't bother, you won't miss a thing if you're not there when the Universe contracts. After some ten to twenty trillion years of rewinding, the Universe would eventually go zip, as if it never existed. It's the event known as the Big Crunch -- `crunch' in the mind of scientists apparently being the opposite of `bang'.

But will the Universe really vanish? At the moment, most cosmologists don't think so. The latest evidence suggests that the Universe will keep expanding forever, becoming an ever emptier and colder place. Yes, that gives some problems of it's own -- but that's another story. However, the question whether the Universe will shrink or expand forever is still not completely settled.

But then again, many theorists think that the Big Crunch won't be the ultimate end. As the Universe is shrunk back into a ridiculously tiny proportion known as the `Planck length', it would go Bang again. The Universe would expand once more, and everything would start all over again, ping-ponging us forwards and backwards in time forever.

Oh, boy. Starting to feel dizzy already?

BIG EXPANSION – AD 100 TRILLION YRS

So, what if nothing really happens? What if the world isn't struck by meteors, destroyed by divine hand or blown to bits by scientists? Well, in the long run, we might sleep. Not just for the nights, but also during the day. We might even sleep our entire lives, from birth to death, without ever waking up. What's more: the survival of our species may depend on it.

Luckily, it will take some time before it gets that far. Something like *one hundred trillion* years to be precise.

Our Universe expands. Ever since the Big Bang blew all matter, space and time into existence, the Universe grows. The Universe expands and cools, much like the fire cloud after an explosion gets bigger and colder. And that's exactly what astronomers see as they study the sky: all stars we see rush away from us and from each other at tremendous speeds.

But time is ticking. According to the latest insights, the expanding and cooling of the cosmos will go on and on and on. Galaxies and stars will be further and further apart. Stars will slowly become dimmer, as they move out of sight. The night sky will become darker and darker. And darker still, until there's absolutely nothing to be seen.

What's more, stars die. After a lifecycle of several to many millions of years (depending on their size), every star is destined to spew out its last bit of energy and collapse, becoming a cold `neutron star', a `white dwarf', or a black hole. As time passes, this will happen to more and more stars, creating a Universe full of burnt out dead stars and black holes.

Deepest Space: the outer limits of the Universe

And black holes `eat' other stars. A black hole has such immense gravity, that no star or planet can resist it. The increasing number of black holes will sweep the Universe clean, much like the devil in St. John's biblical vision of the Apocalypse sweeps the stars from the sky with its tail. It will become even darker still. And oh, by the way, our own Sun will die too, about 5,000 million years from now.

So what about us? Suppose man somehow finds a way to survive all these cataclysmic events. Suppose humanity colonizes other, `safer' planets. And, for argument's sake, just suppose humanity is somehow able to dodge all those mean, black holes that scavenge the cosmos. What would life be like?

First, we would find ourselves in an increasingly cold, numbingly dark surrounding. We would be truly alone in the Universe.

But that's not the biggest problem. With the stars and the Sun long gone, we'll find ourselves in the midst of an energy crisis of unimaginable proportions. And terrible enough, in all the dark and the cold, we need energy more than ever.

Just hack up some atoms in a nuclear power plant, you might say. But that's not a good solution. By physical law, the energy within atoms decreases as the Universe expands.

And, bizarre as it may sound, the supply of atoms is ultimately limited. The matter on our planet is, of course, finite. And in the nothingness of the faded-out Universe, matter is hard to get at. It's either beyond reach or eaten up by black holes. And there's no more particles raining down on our planet from solar radiation, meteors or cosmic dust.

In the long run, we have to come up with something to adapt to our new environment. And `adapting' means more than getting used to cold feet and being able to see in total darkness: it means cutting drastically on our energy bill.

First, we'll have to get rid of our bodies. No, really! Our carbon-based bodies are very vulnerable to cold. They get damaged even when temperatures drop only a few degrees. It's absolutely certain there's no way life as we know it can survive for a substantial period of time in an expanded Universe.

But that's no big deal, Princeton physicist Freeman Dyson and many others suggest. We `only' have to transport our consciousness into something else. A cyborg, an interstellar cloud of particles maybe -- with one hundred trillion years ahead, we have plenty of time to come up with something.

! So okay. Grudgingly, you've turned yourself into a cyborg. But in the long run, even that isn't enough. For one thing, rgy. Just think of your computer doing its calculations: the un if you didn't have it connected to a power source.

universe gets colder still. This brings out other, very weird own. The speed of thought will drastically decline in monstrated. So there you are, you've decided to become a nd out you're sooooo slooow-witted.

And when temperatures drop even further, there's more trouble facing us poor former humans. It'll be so cold, even a cyborg would get into trouble. A point comes when organisms cannot lower their temperatures any further without becoming less complex -- in effect, dumbing down. Before long, life could no longer be regarded as intelligent.

It's here where sleep comes into play. As Dyson calculates, there's only one possibility to survive. We'd hibernate. By sleeping, our metabolic rates will drop, and we will be able to achieve an ever-lower body temperature. In fact, by spending an increasing fraction of our time asleep, eternal life would indeed be possible.

So you've become a slow-thinking robot that's asleep most of the time. Still, even that may not be enough. For example, what kind of alarm clock would you set to wake you up? Your alarm clock would have to operate reliably for a long, long time, using less and less energy. A curious but, scientifically speaking, dead serious problem, that no physicist has been able to answer yet.

And then there's the problem of thought. In the early 1980s, computer researchers realized that in principle it's possible to design a computer that doesn't dissipate energy while processing information. Isn't that great news for all those dormant cyborgs to come?

No, it isn't. To function, this computer -- that only is a theoretical possibility so far -- must never, NEVER discard any information. If it does discard only one bit of information, it will be like pulling the plug out of a bath tub: it would use up energy while calculating for ever more.

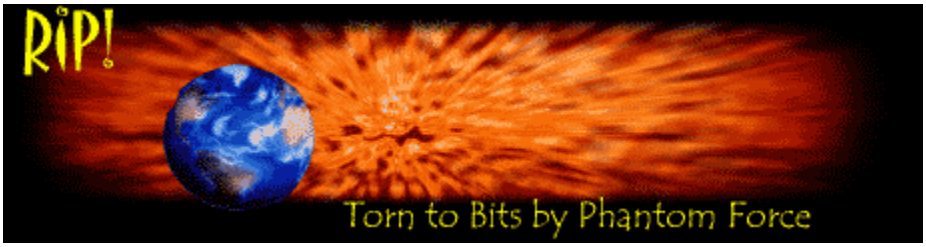
But thoughts are finite. Information is by definition stored in a finite amount of particles. Even in your cyborg brain, there will come a point where you would have to discard old information in order to store something new. And that IS a problem.

`All organisms would ever do is relive the past, having the same thoughts over and over again,' cosmologists Lawrence M. Krauss and Glenn D. Starkman estimate. `Eternity would become a prison, rather than an endlessly receding horizon of creativity and exploration. It might be nirvana, but would it be living?'

Nope. Probably not. There you go, Mr. Cyborg: constantly asleep, and when awake only rethinking old thoughts.

Perhaps it's best our world is swallowed by one of those big, mean Black Holes after all.

BIG RIP – from AD 2060



Back in the Middle Ages, stretching you up a bit on a draw-bench was a popular way of torture. Unfortunately, chances are that one day, we will all know how it feels. Some cosmologists think that getting ripped to bits is what awaits us in the end. That hurts!

Long before all hell breaks loose, we'll know something is coming. Our astronomers will notice something weird in the sky. The galaxies no longer seem to clot together in galactic clusters. They just fly about through the cosmos, as if there's no such thing of gravity pulling them together.

Next, the same thing happens to the stars that make up the galaxies. Slowly, their bonds begin to loosen. The Milky Way seems to evaporate, as the stars it is made of begin to fly off in all directions. The same effect is seen in other galaxies. Scientists are baffled. This cannot be happening! It is as if gravity simply ceases to exist. Or consider this other possibility: as if something really weird and hefty is pulling on the stars from the outside, unraveling the galaxies, pulling everything apart.

And that, my friend, is just the beginning. Next come the planets. Suddenly, the mysterious, invisible force begins to peel them away from their stars. Our solar system is no exception. Jupiter, Saturn, Mars -- one after the other they drift off into deep space, not to be seen ever again.

Oh, and then there's this other tiny planet -- 'Earth', it is called. It obviously undergoes the same nasty fate. The inhabitants of the planet will notice that their star, the Sun, grows dimmer and dimmer as the Earth is pulled further and further away from it. Years will grow longer and longer.

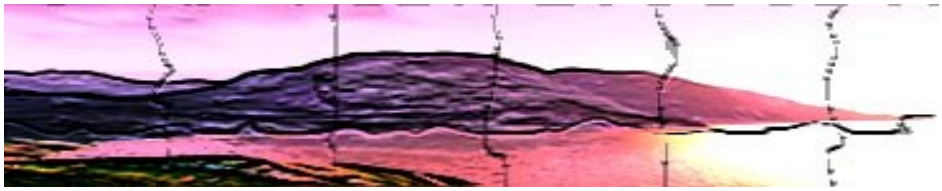
But in the long run, Earth will be lost too. The Sun will become just another star in the sky, and on Earth, night will fall forever. Earth will simply drift off and become a lost, deep space planet without a Sun.

Probably, the inhabitants will try to make the best out of it. They will cuddle together, and turn up the heating -- even though life without sunlight eventually is quite impossible. But it doesn't really matter. For the next thing you know: here is that mysterious pull

again.

This time, the Pull kicks in ferociously. Suddenly, we'll all feel a little -- well, not so fine. And the moment after that, Earth and everyone one it is torn to bits. Just like that. Mountains explode, the Earth's crust cracks open, and so will the bodies of everyone on Earth. We'll explode, it's as simple as that. Do you mind if I spare you the gory details? But seconds later, it is all over. Earth no longer exists. It has become a messy cloud of space debris and organic matter, just like all planets in the Universe.

Then, finally, the Pull literally wipes clean the Universe. It grinds all matter. Not a grain of sand, not a blade of grass escapes. Next, it goes on to rip up all matter into atoms. Then, it tears apart even the atomic nuclei matter is made of.



And then? Then it will all be over. All will be quiet again. The Universe will have become a cold, lifeless, totally deserted place, devoid of even the tiniest speck of matter. If that isn't the end of the Universe, what is?

Well, no need to wet your pants yet. Even in the worst case, it will take something like 22 billion years before it gets this far. That's 22 million million years! The current age of the Universe seven times over. And even then, there's a chance it will take much, much longer before the Big Rip rolls in.

On the other hand: it isn't really a comforting thought that the Big Tear-Up isn't some kind of oddball theory. It is hard-boiled science. The Big Rip really seems to be what we're heading for, the calculations show.

So: What is going on?

There's no easy way of explaining what causes the Pull we're dealing with here. It all has to do with how the Universe works.

The story goes something like this. 13,7 Billion years ago, all matter and energy and time blew into existence, with the surrealistic explosion we call the ‘Big Bang’. Ever since, the Universe expands and cools, much like a ball of fire escaping after a huge explosion. The debris - that’s the stars, the galaxies, the planets and us - flies off in all directions. Everything in the Universe gets further and further apart from each other since the dawn of time.

But in recent years, scientists discovered there is something weird going on, too. Galaxies at the edges of the Universe don’t seem to slow down as you might expect. Instead, they speed up. Some bizarre and totally unknown force seems to be pulling on them from the outside, the calculations show. The expansion of the Universe accelerates. And so-called ‘Phantom Energy’ is what causes the pull.

It is hard to imagine how extraordinarily super intense this Phantom Force really is. It compares to nothing we know of in nature. To give you an idea: try to add up all the forces you can think of. Take every atom in the Universe, turn it into an atomic bomb and collect the power of all the explosions. Next, take every star that ever burnt in the Universe, plus every star that will ever burn, and tap all the energy it will ever give off. Now, add up all this energy. What you have now is slightly less than three percent of Phantom Energy, a mere fraction of the biggest beast we know in nature.

By now, you’ll begin to understand how serious the situation really is. Right now, Phantom Energy is only stretching up the Universe a bit. But in the long run, it will get bored with that. It will start unraveling the Universe itself: the stars, the galaxies, and yes, those tiny worms calling themselves ‘men’.

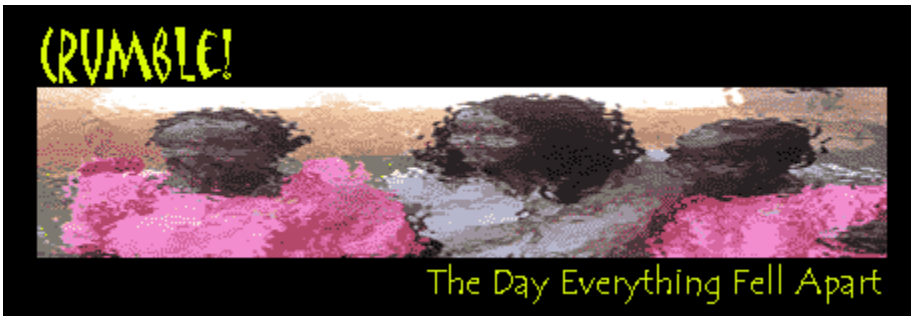
We don’t know exactly when we will begin to feel the Pull: that depends on the details of how Phantom Energy works and how big it is exactly. According to one calculation, done by US physicist Robert Caldwell in February 2003, the Big Rip

could kick in 22 billion years from now. At sixty million years before the end, the Milky Way is destroyed. Three months before the end, there goes the Solar System. Thirty minutes before the end: boom, that was planet Earth.

Gladly, the Big Rip-theory still is controversial. As you can read elsewhere on this site, some scientists still think the Universe will go on expanding forever -- without atoms or people getting ripped apart. A small minority believes the Universe will eventually stop expanding and start shrinking again, a totally wacko situation involving a reverse-Universe with time running backwards.

And for what it's worth: it is, of course, questionable if we will still be there when the Big Rip sets in. First, we'd have to survive meteor impacts, supervolcanoes, robots,nanotechnology, biotechnology, black holes, incoming stars and planets, ice ages, depopulation, infertility and the death of our own Sun - to mention only a few.

BIG CRUMBLE – AD 3 TRILLION YRS



It is a problem so strange only a handful of physicists know about it. Well, that is until one day, the 'problem' becomes real. It will be some bizarre event. For on that day, everything in the Universe will fall apart.

Just picture it. You're standing in the subway during rush hour. Then, suddenly, you hear a funny sound. It is the guy standing next to you. He looks ill. And then, the incredible happens. Right before your eyes, the poor fellow crumbles, much like a piece of porcelain breaking up. He literally cracks up into thousand pieces. And then -- he's gone. Just that: gone. You find yourself standing at a foul-reeking muddle of liquid on the floor.

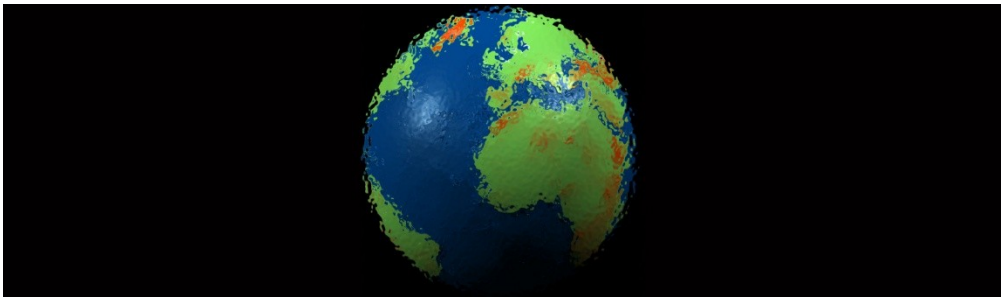
You are, of course, stunned. But wait, see that lady over there? Oh no, she's crumbling, too! And look, that old man over there -- he's also vanishing. One by

one, people on the subway just... go liquid. Suddenly, you're all alone. Where commuters used to be, only little pools of liquid remain.

You gasp for breath. But then, suddenly, you feel a little... weird. It is a kind of pain that isn't really pain; a kind of sickness that isn't really sickness. "What...", you utter. But then you utter nothing more. Your body makes a wettish 'splash' as it hits the floor.

What has happened to you, is a weird and little-known phenomenon, a true freak of physics. You've been hit by the changing of the 'fundamental constants'. And the bad news is this: more and more scientists believe the disaster is real -- and inevitable. Yes, you read that right: inevitable. Like it or not, the Universe seems to be heading towards the Big Crumbling.

And people going liquid on the subway is only one thing. If you looked up, you would perhaps witness the Sun exploding. Oh, and all stars would explode, too. Planets might swell, like balloons. Trees, animals and plants will crumble and liquefy, just like you. All kinds of rocks will come apart and vaporize. It is in fact hard to predict what exactly will happen in what order, when the fundamental constants reach their critical values.



There, we've said it: 'critical values', 'fundamental constants'. Understanding what went wrong isn't a piece of cake.

First, you should know the Universe and everything in it is based on certain fixed numbers. The speed of light is one of them: no matter where you look, the speed of light is ALWAYS the same. It is a constant. A given. The speed of light is just the way it is -- no more, no less.

And there are many more constants underpinning nature. All in all, there are about 25 of these physical 'holy numbers'. There's the mass of the proton. The strength of the electromagnetic force. The strength of gravity. The strong nuclear force. The 'Planck constant'. 'Avogadro's number'. And so on, and so on.

There's a very peculiar thing about the constants. They make us possible. All of the constants have exactly the right values to make the Universe possible. Had one of them been only a smidgen bigger or smaller, molecules wouldn't be stable, stars

wouldn’t be there, and you wouldn’t be here reading this. So we should consider ourselves very lucky the constants are exactly the way they are.

But the thing is -- we’re running out of luck. In 2001, physicists studying distant galaxies discovered something totally weird and unexpected. One of the constants, the so-called ‘fine structure constant’, seems to be changing! Very, very slowly, it is getting bigger.

This ignited a debate that rages until this day. Other scientists simply can’t believe it. Constants should be, well, constant. But in the meantime, there’s more and more evidence they’re not. There are clues the mass of the proton is on the move, too. And the speed of light and the Planck constant -- all gooey. Now take a long, deep breath and think about this for a while. Very slowly, the very foundations of the Universe are getting unstable!

Yup, you get the picture - that’s bad news. It means the Universe is heading for destruction. It will take many billions of years. But in the long run, the constants will change our Universe completely. Atoms will no longer be possible. Stars will no longer be stable. Matter itself will no longer be able to exist.

There you have it -- the day everything falls apart. It is estimated that if the fine-structure constant were only 1 to 3 percent bigger than it is today, carbon will become unstable and cease to exist. That’s where people will fall apart: everything that lives is made of carbon. No carbon, and all that will be left of you is... well, the wet stuff.

And that’s just one thing. If the force of gravity were to dim just a few percent, stars would go out. If it got a tad bigger, stars would overheat and explode. If the ‘strong nuclear force’ grows slightly, the Sun would burn up in less than a second. If it goes down, the stuff known as ‘deuterium’ (H3) falls apart, and the Sun goes out. Hey, we could go on like this forever!

So... should we brace ourselves? Well, not yet. No matter how certain the Big Crumble is, it will still take an estimated 3,000 billions of years before we’d begin to notice it. That’s 3,000,000,000,000 years from now! What you call: the distant future. By that time, at least you don’t go about in subways anymore. In fact, humanity probably won’t be there at all anymore. We will have evolved into something else, or find ourselves killed by meteors, the exploding Sun, robots or supervolcanoes.

LINKS OUT

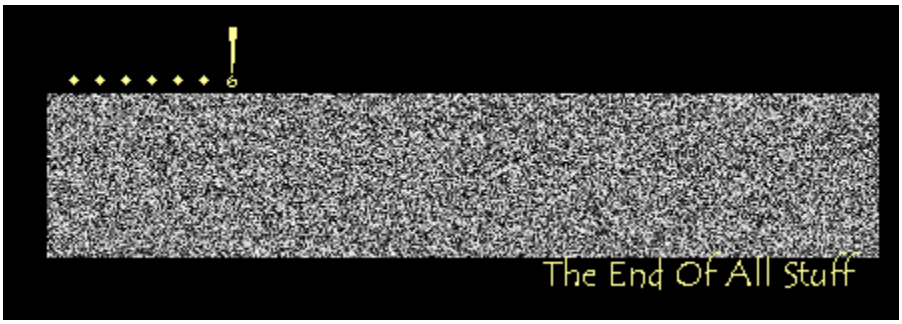
Variable fundamental constants? - By researcher Michael Murphy

The fundamental physical constants

Are the laws of nature changing with time (Physics Web)

Sacred constants might be changing (PhysOrg)

ETERNITY – AD 1 GOOGOL YRS



Please, don't go insane now. Of all the apocalypses on this site, the one you're about to read is probably the most mind-boggling of them all. For what will eternity look like? Think of a place where everything has ceased to exist, where golden parkings pop out of nowhere, Napoleon Bonaparte comes back to life and the Twin Towers resurrect themselves. Still, this incredible place is exactly where we are heading, physicists expect.

Empty your mind. We're about to take a BIG leap into the future. Not just a lousy few billions of years, but 10 000 000 000

seem to decide yet which is more likely. And even if the Universe doesn't do that, we're destined to face a weird and horrible crisis, which involves us spending our lifetime as sleeping robots.

The problem is that the Universe gets bigger and cooler. Ever since the Big Bang, it expands, much like an expanding ball of fire after an explosion. Right now, the Universe is still young. It has these cute stars and twinkling galaxies. But in the long run, that will change. Slowly but inevitably, the Universe will empty itself.

First, the galaxies will fly out of sight, beyond the horizon of what we can possibly see. Next, the stars in our own galaxy will burn out, one after the other. The only thing that will remain, is a dull graveyard of cold planets, dead suns and black holes. In about one hundred trillion years, the Milky Way will go black, astronomers expect.

Big Nothing: Eventually, the Universe will become a dark, sterile place

And eventually, even this graveyard decays. One after the other, the dead stars and planets are eaten by black holes, or kicked out of the Milky Way by collisions. Astronomers expect that in one hundred to one thousand billion billion years, our galaxy has dissolved completely.

Time goes on. After a while (more trillions of years) something else will kick in. You'll notice that even the very stuff nature is made of, isn't stable. A proton, the particle you'll find in the core of atoms, has an average lifetime of 100 000 000 000 000 000 000 000 000 000 000 000 years. Wait long enough, and it will suddenly vanish. Poof, gone. The same goes for light particles, the so-called 'photons'. They're expected to last a few zero's longer, but in the end, they too will kick the bucket, one after the other. Isn't that just bizarre? The light will go out, literally.

The last thing that survives, are the black holes. But in the end, they too will vanish. They will evaporate in a puff of radiation.

So there we are, at our unimaginable one googol years. Finally, the Universe is totally and utterly empty. You won't see any light or spot any planet -- in fact, you won't even find the tiniest speck of dust. The Universe has sterilized itself. All there is left, is emptiness, and darkness. Total oblivion. And worst of all: there's nothing we can do to stop it. We can build fancy machines or futuristic devices all we like -- but in the end, they'll all get kicked out of existence, when the matter they are made of simply vanishes.

So there you have it: infinity. Booooring, we must add.

But don't sob. There's an upside.

As the quadrillions of years pass by, something very odd should happen. In eternity, even the rarest events get a chance to occur. Weird, bizarre phenomena that only happen once in a zillion years or so, become quite normal.

For example: the nothingness should yield a few surprises. Already, physicists know that in a vacuum, there are sometimes tiny little energy ‘blobs’. Little, random fluctuations of the so-called ‘quantum vacuum’. Out of nowhere, tiny particles pop in and out of existence. But theory predicts that on very, VERY rare occasions, the fluctuations should be a bit larger. Out of nowhere, an entire atom might appear! Or hey, the vacuum may even spit out a few of them!

Think of it like the static on TV. Wait long enough, and out of the random fuzz, a recognizable image might materialize. Wait REALLY long, and one day a complete episode of The Bold And The Beautiful should accidentally show up!

In the vastness of eternity, even things that are almost impossible become real. Like the sudden appearance of, say, a light green buste of Napoleon Bonaparte.

In the Universe, this should give some **really** surprising results. With eternity at hand, the vacuum should begin to yield all kinds of objects. Incoherent lumps of random garbage, most of the time. But on very, very rare occasions, you’ll see other objects popping into existence. The Eiffel tower. A purple camel. A golden parking garage filled with chocolate Cadillacs. Napoleon Bonaparte sitting next to Mike Tyson on top of a stack of comic books. As the googols of years pass by, it’s all there.

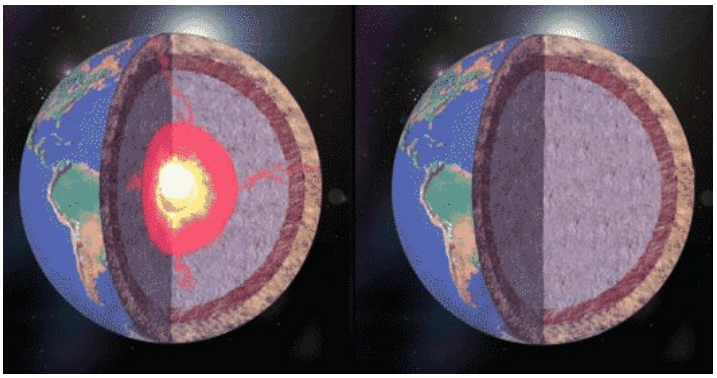
In the VERY, VERY, VERY long run, the vacuum will even belch up complete planets, and beautiful stars, burning and all. Theoretically the vacuum should even churn out a complete solar system one day, identical to ours, with a planet Earth inhabited by people. "In an infinite amount of time, one day, I will reappear", as physicist Katherine Freese of Michigan University once put it. "An crazy thought, but true."

One day the black nothingness should even produce a new Big Bang. Admittedly, we’ll have wait really long for it to happen. Researchers of the University of Chicago once tried to calculate it. And according to their best estimates, it should happen somewhere over the next 1 000 000 000

000 000 000

and thus constantly adds rock and soil to our world. Just think of it: every mountain you see, every piece of stone you pick up: it was all once liquid magma!

But there's trouble ahead. Very slowly, the Earth is cooling down from outside in, much like an oven dish placed in a fridge. The Earth is freezing. In the end, the Earth's core will no longer be liquid, but solid. Our planet's restless bowels will calm down -- forever.



The Core, before and after

The first thing you would notice is less volcanoes, and less earthquakes. Hey, that's fun -- but it's just the beginning. Slowly, wind and rain will begin to erode the Earth away. Very gradually, mountains will shrink. Grain by grain, they will crumble down, and get washed away by rain and rivers, into the sea. It will take hundreds of millions of years, that's the good news. But the bad news is that in the end, there will be no more land left! It's a bit strange to imagine, but when you level out all the land evenly across the globe, and smear it out onto the bottom of the sea, you would find nothing will be stick out of the water. No continents, no rocks, no islands, not even a sand bank. All that will be gone forever.

So okay, you decide to live on some kind of ship from now on -- with many millions of years ahead, there's plenty of time to build some sort of Ark. But wait. Next thing you know, the deeper, liquid metal core starts to freeze up, too. And that means the Earth's magnetic field will weaken -- and go out. Forever.

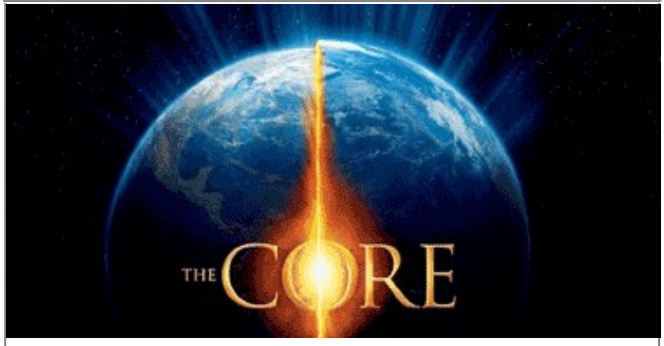
Now that really brings out the beast. As we explained elsewhere on this site, no magnetic field means: no protection against space radiation. We will have more cancers, and more blackouts. But that's not the big issue. The worst part is, our atmosphere will begin to vanish. Very slowly, molecule by molecule, the stuff we call air will be lost in space.

It's the solar wind doing this, my friends. Without magnetic field, the stream of particles coming from the sun can quietly eat away the atmosphere. The atmosphere will literally be blown away, direction deep space!

According to some researchers, exactly this is what happened on Mars a few billions of years ago. Mars is much smaller than our planet, and accordingly, it froze up sooner. Scientists believe this is what killed Mars. With it's magnetic field down, the Sun could blow away Mars' early atmosphere. After a few hundreds of millions of years, it was gone.

Hey, but Mars has this other thingie too: it has no liquid water. Well -- the same lies in store for our planet. With no atmosphere, there is no air pressure to hold down the water. All water would simply vanish into thin air -- literally.

So just imagine it: you're sitting in your Ark, wearing a space suit -- when suddenly, ahoy, land in sight! But pretty soon after that, you'll find that land is about the only thing left. Oceans become lakes, and lakes become ponds. And in the end, the ponds will evaporate too. Oh, now that's cool -- now you're without water, too.



Can "The Core" really happen?

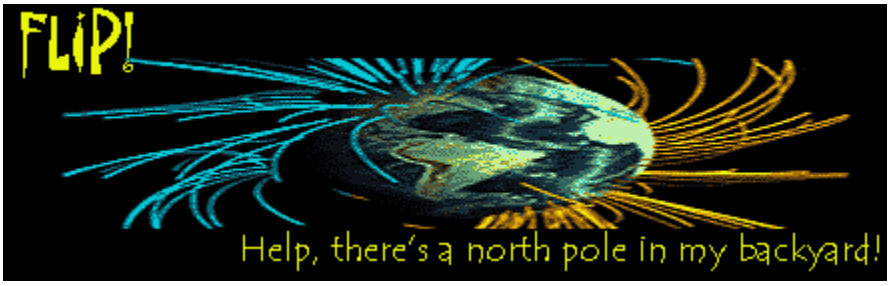
In the Hollywood movie "The Core" (2003), the Earth's core suddenly becomes 'deactivated' -- for reasons that remain unclear throughout the movie. It's a bad movie, and so is the science behind it. There's just no way the huge, soaring sea of molten metal below our feet can suddenly 'stop'. The core is bigger than the planet Mars! Really, there's no stopping it. What's more, 'reactivating' the core with a nuke is total nonsense, too. It's the kind of stuff that only happens in movies -- not on the real planet. "Monumentally dumb" -- that's what The New York Times called it.

We'll find ourselves on a kind of Mars the Second: a lifeless, airless, waterless, dead world -- with only some gullies and dried-up river beds remembering of its more lively past.

If that doesn't depress you, there's this: the freezing of the core seems quite inevitable. It isn't some speculative, weird phenomenon -- most experts agree the freeze-up is indeed going to happen one day.

Fortunately, you and we won't be there to tell the tale. We're looking at billions of years, before the freezing really begins to show. Some 2,000,000,000 years, it is estimated. That's plenty of time to make a nice space suit for everybody on the planet.

POLE SHIFT – 2300 to 2400

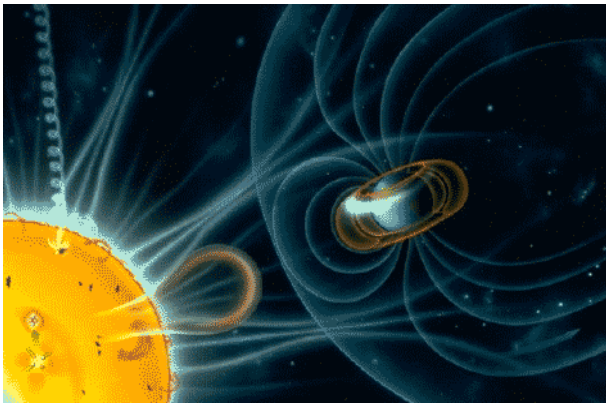


Not good: the magnetic field of the Earth is fading -- and fast. It seems to be preparing to flip over. Suddenly, our compasses would point southwards. But will there still be someone around to notice it?

They say it gives you cancer. That it makes the use of electricity impossible, throwing us back into the Middle Ages. It should turn the atmosphere into a deadly brew of toxic gases. That's how it goes, when suddenly, the Earth's magnetic field stops -- and flips over.

In case you didn't know -- the Earth is in fact a giant magnet. Around it, there's this huge magnetic field, invisible to the eye. It's a force field, really. It protects us against dangerous, incoming radiation from the sun and from deep space. If you're an incoming space particle, the field will drag you away, and drop you somewhere on the south pole or the north pole. You can see this as it is happening: the rain of space particles is what we call the Aurora Borealis, the northern light.

But every now and then, the magnetic field fades, and flips over. North becomes south, and south becomes north. Such magnetic flip-overs are probably just as common as Ice Ages. On average, they occur once every 250,000. But the last time it happened, it was 780,000 years ago -- so you could say it's time for the planet to flip again.



The Earth strikes back: the magnetic field pushes radiation from the Sun away

And hold your horses, our world might be doing just that. For at least three centuries, the Earth's magnetic field has been fading, in an ever faster pace. Right now, it is about 10 percent weaker than it was when scientists started keeping track

of it in 1845. Also, there's the poetically named 'South Atlantic Anomaly'. That's a huge chunk of Earth, deep underneath the ocean floor, where the turnover has already begun.

Gladly, the pole shift doesn't mean the world is about to 'fall over' or something, as many people fear. The ice caps won't suddenly move to Africa. During flip-over, only the **magnetic** poles change position. You will have to change the name 'north pole' into 'south pole' and get used to the fact that compass needles point southwards from now on. That's basically it.

But you wouldn't be reading this on a site about the end of the world, if there wasn't some problem, too. When north and south swap, our magnetic space shield will be down for a while. In fact, computer simulations suggest an even more bizarre scenario. For thousands of years, there will be multiple magnetic poles, aimlessly wandering about. There will be a few magnetic north poles lumbering through your backyard, while another magnetic pole -- say, a south pole -- will pass in front of your house.

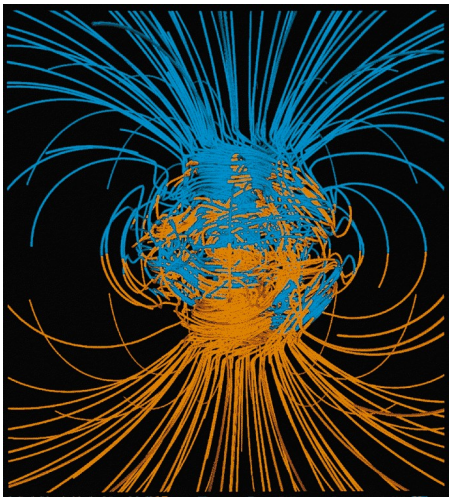
This will have all kind of bizarre effects. Birds and other migrating animals will lose their way. Ships, airplanes and travelers relying on compasses will get lost, too.

Meanwhile, the night sky is filled with ghostly streaks of colored light -- that Aurora Borealis again, but this time in your backyard. There will be power cuts, as the Earth is hit by solar radiation. Watching TV, listening to the radio or talking over the telephone will become difficult, and sometimes impossible. Communication lines will be downed; satellites will be zapped. There could even be spontaneous outbreaks of fires -- this is what happened during an extreme solar radiation storm in 1859. And back then, the magnetic field was on!

Meanwhile, your body is zapped, too. The invisibly small space particles shoot through your body, ripping through your DNA. This can give you cancer, or horribly mutated offspring. For several thousands of years, it will be like living next to the crashed nuclear plant of Chernobyl. Well, with the exception that in Chernobyl, you could at least use the telephone!

So gradually, humanity will be reduced to a monstrous, sick, cancerous and demented bunch, right? Well -- perhaps not.

Indeed, all unpleasant effects outlined above are real. But science agrees that they won't be that severe. The magnetic flip won't wipe out our civilization, as many doom sayers suggest. Fact is, we can do without our magnetic blanket for a while.



The field

Take a look at the cancers. It is estimated that without magnetic field, we would have 15 extra cases of cancer in every 1 million people a year. That is of course awful -- but hardly catastrophic. Each year, more people die of the common flu!

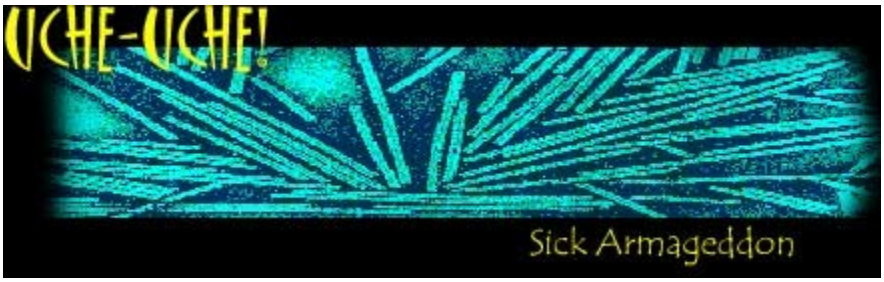
Without magnetic field, Earth is still protected by its thick atmosphere. If you're that evil particle from outer space again, you will have to zig zag your way through a thick soup of oxygen, nitrogen and other gases first, before you can finally shoot a human being. Chances are that long before, you will have bumped into an atmospheric gas molecule.

In fact, there are two places where the magnetic field is almost zero already: the north and the south pole. There, the field dumps the space particles it has caught -- right on the heads of the Inuit (Eskimos) and polar explorers. But despite all that, the Inuit and the explorers are doing fine. Even their electricity works.

And if that doesn't calm you down, consider this. You and I won't live to witness the next swap. It should take at least a few more centuries, before the poles come marching in.

That being said -- one nightmarish fact remains. In the long run, the magnetic field could indeed kill us all. In a few billions of years, chances are the field shuts down for good because the Earth's core freezes... But that's another story!

DISEASES – any day now



It's odd: you can worry about meteors and cosmic explosions all you want, but the biggest killer of all times is already here -- and is doing fine. In fact, life's oldest and most deadly enemy is preparing for yet another devastating attack on the human race. Diseases -- don't ever underestimate them.

Humans and germs have always lived side by side. But every once and a while, the germs attack. Then, suddenly, there's AIDS, or SARS, or what-have-you.

And SARS is still a relatively mild, merciful disease. The Black Plague killed hundreds of millions of people, at its high-day ridding Europe of a quarter of its population. The Spanish flu that ran rampant in 1918 killed twenty to forty million men, quadrupling the death toll of World War One. In the US alone, the epidemic killed more people than World War II, the Korean war and the Vietnam war combined.

Sure, our doctors like to reassure us that everything is under control by now. No offense -- but that's a lie. The grim reality is that our world is more vulnerable to disease than ever.

That's because our world is so densely populated. Intensive agriculture brings humans closer to animal pathogens. And people themselves are a sociable species, constantly interacting with each other, and traveling around the globe all of the time.

Nothing new with SARS: In 1918, the whole world carried masks as the flu suddenly went berserk.

And the diseases? Haven't we seen them all by now? And cured them? Well: we haven't. The big problem is that viruses and microbes aren't inert, lifeless things. They live. And like all that lives, they evolve.

That's why there will always be new diseases. Evolution constantly throws new, lethal germs at us. Suddenly, some innocent animal virus 'jumps' the species barrier and begins to slaughter humans. AIDS started out as an

innocent monkey disease, the Spanish flu of 1918 jumped from pigs to humans, Ebola probably comes from bats and SARS is closely related to a virus that lives in ducks and cows.

And don't look now: this 'jumping' happens all the time. Apart from SARS, AIDS and Ebola, recent years saw the coming of exotic, lethal germs like the Marburg virus, the Sin Nombre virus ('virus without a name'), Lassa fever, Nipah virus and Hendra virus - to mention only a few. And it isn't exactly comforting to know that some diseases kill virtually everyone they infect - like AIDS.

Or consider the flu. Say 'influenza', and you tend to think of a mild disease. But in fact, the flu is by far the most lethal opponent of human life on Earth. In it's lethal, 'Spanish Flu' form, influenza causes you to die a horrible death. No, you just DON'T want to know the details.

Ok, you do. In a matter of days, you'll see your hands and feet turn black, as they literally begin to rot away. You'll cough up blood and lung tissue. You'll have seizures and hallucinations, as the fever boils your brains. And in the end, you'll slowly drown, as your lungs are filled with slime and discharge. "Terrible names were whispered", a witness to the 1918 epidemic wrote. "This was not influenza. This was a plague. The world was coming to an end."

Clearly, there's no underestimating influenza. The virus is highly contagious, incurable and can kill up to ninety percent of those infected. And it is the fastest evolving thing we know of. This makes it move frighteningly fast, constantly jumping from one species to the other.

In 1997, 1998 and early 2003, new strains of influenza jumped from chickens to humans in Hong Kong, killing eight people in total. In April 2003, another bird flu strain contaminated eight people and killed one in Holland. In all cases we were lucky: the flu didn't combine with a human flu virus, turning it into a virus that's contagious for men.

But it is a matter of time before it does. Then, we'll have a monster on our backs. SARS, anthrax and smallpox could be just flimsy colds, compared to the next strain of killer flu. In fact, the new strain of 2003 is still very active today, in Asia. Virologists are really worried.

Virus Busters: More Ebola-like killer outbreaks likely await us

And if that didn't frighten you yet, there's the eerie possibility that a notorious `old' disease such as the measles, cholera, tuberculosis, smallpox or, yes, the Black Plague suddenly makes a comeback. A lot of germs are about to become resistant to drugs such as antibiotics. This is one of the BIG concerns of

medicine today. In Japan and in Africa, the first strains of `invulnerable' superbacteria have already made some victims.

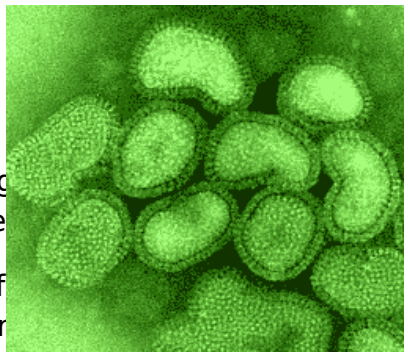
One of them is MRSA, a notorious hospital bacterium that is resistant to most antibiotics. Luckily, it is a rather obscure bacterium, that usually hits the sick and the elderly. Then, in early 2003, something really awful happened. Suddenly, MRSA started to infect the healthy, causing terrible sores and abscesses.

And you don't want to get the latest version of tuberculosis, either. Running rampant in Eastern Europe, this super-tuberculosis is so resistant to drugs, it is very hard to treat.

With diseases, it's like beetling about in a minefield. You can take a few steps -- but the next step, you could suddenly kick the bucket. And the bad thing is: no-one knows when, where and how it will go wrong.

However, there's one small comfort. It is very unlikely a disease will wipe out the human race altogether. No matter how massive the attack of the germs is, there will always be individuals around that are somehow fit enough to fight the disease -- and survive. Well, at least that's how things went until now.

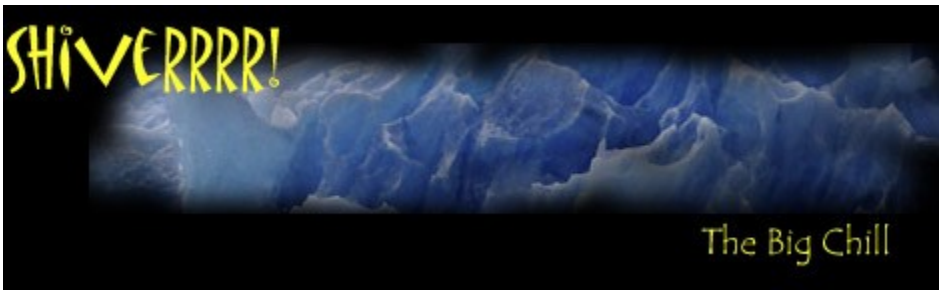
On the other hand, it doesn't really help that humans themselves sometimes create a new disease in the laboratory. Early 2002, an Australian research team turned a quite harmless virus into a fearsome killer by sheer mistake. It literally killed everything it infected. Gladly, the Frankenstein Virus didn't make it out of the lab and into the land of the living taste of what can go wrong when you do genetic enginee



And no, you DON'T want to think of what might happen if terrorist decides to find out what happens when you upgr pieces together an airborne version of the Ebola-virus.

One way or the other, it is almost certain there will another outbreak of some kind of killing disease somewhere. The twentieth century saw the Spanish Flu, AIDS, Ebola and many, many other, less heard-of epidemics. What will the 21st century bring? Let's hope we can at least blame nature for the damage, and don't have to learn that some careless scientist made a horrible mistake.

ICE AGE – any day now



Don't tell Al Gore! We can worry about global warming all we like, but one thing is absolutely, 100 percent certain: sooner or later, our world will plunge into the coldness of an Ice Age. Think of it: Europe and the US covered with ice, winters with polar temperatures and 'summers' with frost all over. And the funny thing is: it could happen suddenly, much sooner than you think.

O yeah, that good old Ice Age. Wasn't that something prehistoric, an aberration of nature somewhere hidden deep in our prehistoric past?

Wrong. In fact, we're still living in an Ice Age today. The ice caps that cover the poles and the mountain tops are the best proof of that. Our Ice Age, dubbed the **pleistocene epoch**, began some 1,6 million years ago. And it still lasts.

So if we're living in Ice Age now, Ice Ages can't be that bad, you say. Oh, but that's only because currently, we live in an Ice Age phase that geologists call an **interglacial**: a period of milder temperatures inbetween ice-cold, frost-dominated **glacials**. During interglacial, the ice recedes to the mountain tops and the polar caps. It just sits there and waits.

But don't mistake: the threat is there all the same. In Ice Ages such as the one we live in, "glacials" is the rule; "no glacials" the exception. While interglacials last only 10,000 to 15,000 years, a typical glacial roughly lasts 100,000 years. Frost and bizarre cold is in fact currently the default climate of the northern hemisphere!

And time's running out. Our interglacial period began 12,000-13,000 years ago, so the next glacial period is due to arrive any millennium now. And a bad thing about glacials is: they may start quite suddenly.

According to one estimate, one evening you will hear the weather report telling you something odd has happened. There is snow in a country where you don't expect it: Israel, Maroc, Egypt or southern China. It is a chance event, it could happen any winter. But this time, it pushes the world's climate into its "glacial" mode.

The snow acts as a mirror, bouncing sunlight back into space. As a consequence, Earth doesn't warm up again as it should. Suddenly and abruptly, our interglacial climate collapses. Within years or een months, temperatures will drop markedly. In the end, temperatures will decline some 15 degrees Celsius (27 degrees F) on average. But in some places, the decline will be up to 40 degrees Celsius.

And as the climate shift rolls into action, there's the usual apocalyptic rumble-a-bumble. Huge storms and heavy rainfall will ravage the world. You will have floods, biblical outpoors of hail and amazing thunderstorms. Cities and entire countries will be disrupted, millions of people will die. It'll be pretty darn nasty!

And then, there's the snow. In the higher parts of Europe and the US, huge piles of snow start accumulating. And the more there is, the more is pressed into plates of solid ice: glaciers.

Meanwhile, the winters become unbearable cold. Rivers and even oceans freeze. Farmlands turn into barren, permafrosted tundra plains. Animals die, plants die, and undoubtedly, you'll buy some extra socks.

Next, after some decades, the first glaciers start moving. Provokingly slow, they begin creeping down from the mountains, crushing everything they encounter, covering ever bigger pieces of land under a thick, lifeless layer of coldness. The icy tongues will crumble one city after the other and munch up entire societies.

By now, you may want to pack your things and move elsewhere. Because there you have it. Ice Age at its best, for a staggering 100,000 years to come. Only the southern hemisphere will be a nice place to be.

But then again, there's a small but alarming possibility that the cold will overrun the entire planet. For reasons not exactly known, this is what happened 2,3 billion year ago, and then again 700 million years ago and 600 million years ago. In those days, there was only life in the oceans. And all the better. On each occasion, the planet

was completely white for many millions of years. The Earth's `thermostat' was totally taken aback by this unimaginable burst of winter.

Heat vs. Cold?

Come on, cut the doom talk, you might say. At the moment, temperatures are rising, with all those humans tinkering with the climate. It isn't very likely an Ice Age will occur in the midst of this era of global warming and greenhouse effect. Finally, there's something GOOD about pollution: it keeps the glaciers away.

Well, not necessarily. The climate instability man has built up over the years could be just what it takes to kickstart Superwinter.

It goes like this: mankind emits a hell of a lot of greenhouse gasses, such as carbon dioxide. But plants and algae live on carbon dioxide. They'll grow and grow, because there's plenty of the stuff around. Already, this effect is clearly seen in oceans, where algae and plankton thrive more than ever.

But then, after some decades, carbon dioxide is up. Be it because of humans switching to other, cleaner fuels, or be it because there are so many algae and plants; the carbon dioxide level in the atmosphere will drop. But all those `extra' plants and algae will still be there, sucking up all carbon dioxide they can get. In a short period of time, they will suck almost all carbon dioxide out of the Earth's atmosphere.

And when that happens, the stage is set for the next big freezing, since carbon dioxide is also the `blanket' that prevents the warmth from flying away from the Earth's surface.

Ho ho ho!: Painting from 17th century Holland, made during a Mini Ice Age. Today, Holland has very mild summers.

Mini Ice Age?

And then there's the "Day After Tomorrow" scenario. In this blockbuster movie, the sea current that brings warmth from the tropics to the northern hemisphere collapses. Within days, an Ice Age kicks in.

The good news is that it's impossible: the Ice Age the movie predicts is too fierce, and comes too fast. But there's a core of truth here, too. Indeed, the Gulf Stream that pushes warm water to the US and Europe is dimming. This could unleash a so-called "Mini Ice Age" in the West.

Now, a Mini Ice Age is something you should be able to survive. Think of a period of several hundreds of years with cooler summers and cold winters - the climate you're used to, but a tad colder. In fact, from about 1300 tot 1800 we did have a Mini Ice Age already!

But don't count your blessings yet. Even a Mini Ice Age would severely disrupt our world -- especially our economies. Harvests would fail. Prizes would sky-rocket. Businesses would go bankrupt. Economies would fall apart.

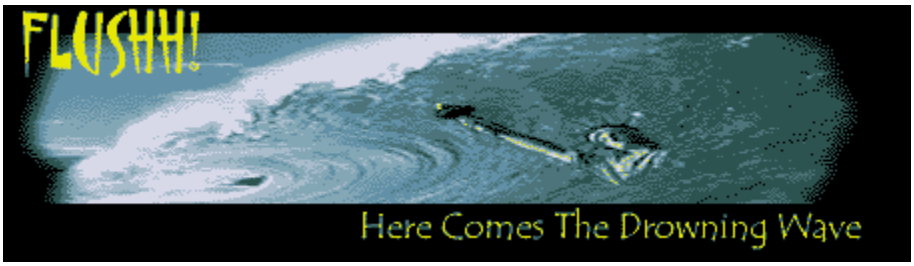
Oh, and there's one more risk. Another eerie hazard threatening our climate is that the Sun one day becomes blackened by cosmic debris, for example when a comet explodes in the face of the Sun. And when that happens, better turn up the heat!

How to make an Ice Age: There isn't one single cause for an Ice Age. These are the 10 most important factors involved:	
1. Widening of the orbit	Right now, the Earth's orbit around the Sun is nearly circular. That's good, because our planet always gets a decent amount of sunshine. But very slowly, Earth's orbit around the Sun widens. About 50,000 years from now, it will be elliptical. On average, we get less sunshine that way. This is probably the most important cause of Ice Ages.
2. Tilting of the axis	Our planet spins around an axis that is slightly tilted. But the axis slowly tips over - and goes back again. When the axis is at its straightest, we will have warmer winters and cooler summers. This should promote an Ice Age: in the winters, you will have more snowfall on the poles, while in the summers, less ice will melt. Luckily, it will take another 20,000 years before the axis is straight up again.
	Even more complicated, the Earth's axis

3. Wobble of the axis	wobbles, much like a top that's running out. One wobble takes 23,000 years. Many researchers assume that this wobbling brings about temperature changes on our planet - and occasionally triggers an Ice Age.
4. Space clouds	Every once and a while, our solar system should pass through a 'Giant Molecular Cloud' - a vast region of dust and gas in space. For millions of years, the cloud would cool our climate, as tiny carbon and silicate dust particles enter the atmosphere and block the sunlight. Some scientists believe this is what caused the 'Snowball Earth' super Ice Ages on our planet, 600 and 750 millions of years ago.
5. Volcanoes	Big volcanic eruptions can spew out so many soot and gas, that the sunlight is blocked out and the Earth cools. Depending on how much volcanic activity there is, this could trigger extreme winters - and maybe even an Ice Age.
6. Meteor impacts, nuclear wars	Meteor impacts and full-scale nuclear wars should do roughly the same as volcanoes. They puff huge amounts of gas and dust into the atmosphere. This prevents sunlight from reaching the surface. Result: a terrible 'nuclear' or 'meteoric' winter that can last for months or even years (depending on how big the mishap was), and possibly an Ice Age.
7. Collapse of the Gulf Stream	The Gulf Stream brings warm water from the tropics to Europe and the US. This acts as a heating system, and keeps the continents about 10 degrees Celsius warmer than they should be. But many scientists think that every now and then, the Gulf Stream breaks down. This could trigger a 'mini Ice Age' in the West -- just like the one that lasted from 1300 AD to 1850 AD. And don't look now: the current has decreased by 20 percent since the 1950s.
8. Meteor dust	A vast asteroid from the Kuiper Belt could

	explode and form a dust ring around the Sun. This would dim the sunlight enough to trigger an Ice Age, some researchers believe.
9. Thinning of the atmosphere	There are several processes which could suck out the methane or carbon dioxide out of the atmosphere. Bad news, because these gases trap warmth. Without them, the Earth would cool dramatically. Perhaps this is what happened when the first green plants appeared: they sucked all carbon dioxide out of the atmosphere, and maybe triggered an Ice Age. Perhaps it will happen again, when we suddenly start using 'clean' fuels. The amount of CO2 in the atmosphere would plummet. This would rob our planet of its warm little blanket.
10. Bad positioned continents	Like the pieces of a giant sliding piece puzzle, the continents very slowly slide across the globe. Sometimes they form a huge super continent, at other times they break up. Many researchers believe the position of the continents affects Ice Ages. Continents on the poles should be bad news. A huge continent breaking up could unleash an Ice Age, too.

TSUNAMIS – any day now



Appalling as the Asian tsunami disaster was, it's absolutely nothing compared to the apocalyptic event that is yet to come. Somewhere over the next stretch of time, New Yorkers will have to deal with a HUGE tidal wave of biblical proportions. Meet the La Palma Megatsunami -- and shiver.

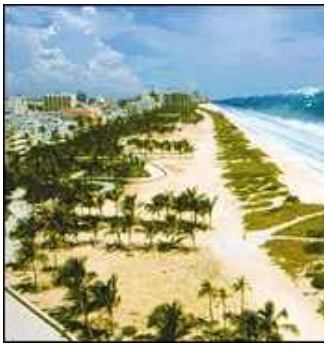
Try to surf this: a wave almost twice as tall as the Empire State Building, and traveling faster than an airplane, at a breathtaking 700 kilometers per hour. Enough to give you the creeps, right? Well, it should. For the question is not so much *if* such a massive wave will one day slosh across the oceans -- but *when*.

And there's more disturbing news. If the Doomsday Wave kicks in, it'll be end of story for the US East Coast. New York City: gone. Boston: washed away. Florida, Miami, the Bahamas -- all history. Oh, several hundreds of years may pass before the Super Wave rolls in. But on the other hand, it could happen next month as well.

It all starts with a faint rumbling of the earth, thousands of miles away. Near the African shore, the volcanic island of La Palma will rumble with seismic activity, announcing yet another eruption of the Cumbre Vieja volcano on the southern half of the island. But this time, the unstable western flank of the volcano doesn't hold. A huge chunk of the island simply breaks off and drops into the Atlantic Ocean. Plunge! No; PLUNGE!

Immediately, up rises a tsunami. And not just a tsunami: the sea is pushed up something like 650 meters, as 500 billion tons of rock and debris hit the ocean. Witnesses to the event will see how a massive wall of water towers up and starts sloshing westwards across the Atlantic, at the astonishing speed of over 700 kilometers per hour. Destination: US East Coast.

Now that will bring about some stress on the other side of the Atlantic. New Yorkers and millions of other inhabitants of the US coastal region will hear about it on the radio: within eight hours, the entire east coast will be splashed away! Hundreds of millions of Americans will get the hell out to escape the wet cataclysm, turning every city and every road in the area into total chaos.



Flush! - By the time the La Palma wave hits the US, it is `only' something like 50-80 meters high -- and twenty kilometers long.

Some people will hope the Mega-tsunami will just break down by itself. And indeed, while crossing the ocean, the wave dims down a bit, until it is perhaps 'only' some tens of meters high.

But the La Palma Mega-tsunami isn't just the next dull wave. It will pass storms unscathed, and bombs won't do it much harm either. You see, the Mega-tsunami we're dealing with is an endless wall of water that stretches out across the entire Atlantic! Not exactly the kind of wave that easily breaks down.

Then, after eight hours, the incredible happens. At the US shore, all water suddenly recedes, as it is `sucked up' by the wave to come. You will be able to see the bottom of the ocean for hundreds of meters ahead. But your attention will be

caught by something else: this huge wall of water, that's moving in on you a lot faster than you think might be good for your health.

As it closes in on the steep coast, the tsunami will grow and grow some more, until it is perhaps several hundreds of meters high. Seconds later, it impacts. With unimaginable force, billions of gallons of water slam into the coastal areas. Skyscrapers snap, bridges are ripped to pieces and outside the cities, forests and villages are swept away. And obviously, if you're still around, it's only likely you're killed in the whole show. The La Palma wave will push thirty to forty kilometers into the land: since the wave is so long, more and more water will be pushed land inwards, until the entire wave has finally rolled onto the shore.

Next, the water mass withdraws. With unimaginable force, the wave is sucked back into the ocean, dragging with it everything and everyone it encounters. So one moment you're high and dry; only minutes later, you find yourself floundering somewhere in the Atlantic, well away from the shore. In effect, the Megatsunami will wash the coastal area clean. It will destroy every city on the US East Coast. And although it won't really bring about the end of life on our planet, millions will die -- not to mention the total disruption of the world when the urban heart of America is swept away.

And by the way, the Americans aren't the only ones affected. More southwards, the Middle and Southern Americas will be struck. Calculations show Europe will suffer as well. The southern part of England will be inundated. Parts of the low lying Netherlands will be flooded. Some parts of the French and Spanish coasts will be severely hit. In Europe too, many thousands will die. Ironically, Africa -- the continent where the Megatsunami comes from -- will be relatively safe, since the Super Wave is pointed away from the continent.

Like almost every apocalyptic scenario described here on Exit Mundi, the one with the tidal wave is nothing really special in Earth's history. You see, it's perfectly normal for a volcanic island to collapse every once in a while. That's why on several occasions in our prehistoric past, giant killer waves rolled over the seas, bringing about doom and destruction everywhere they hit land (see table).

Ohau island, Hawaii	Many times in history, big chunks of Hawaii plummeted into the sea. The biggest event occurred 2 million years ago, when a piece of rock ten times as big as the Mount Everest broke off the island of Ohau. Result: a HUGE tsunami, hundreds of meters high and tens of kilometers long.
Cape Verde	80,000 years ago, the west coast of Africa was rinsed clean, as another massive

island	tsunami hit it at nearly full force. One hour earlier, a massive chunk of the Cape Verde island had plunged into the sea.
Réunion island	4,000 years ago, the island of Réunion in the Indian Ocean snapped in half. Another mega-tsunami popped up. Several hours later, it slammed into the coasts of Australia.
Water fury: Some (in)famous mega-tsunami events. On many occasions, huge tsunamis swept over the continents -- these are only a few we know of.	

And La Palma? Only recently scientists realized that the ideal conditions for the next landslide exist on the island. Actually, in 1949, an eruption of the Cumbre Vieja almost triggered the La Palma disaster. The volcano erupted, the weaker half of the island dropped down four meters -- and halted. It was only in the 1990s geologists realized what a close call it really was.

On the other hand: some scientists hope the island will snap into pieces before hitting the Atlantic. That would almost certainly lead to a smaller wave: compare throwing a piece of rock into a pond with dropping a handful of sand into it.

No-one knows if the island is able to withstand the next volcanic eruption. Gladly, we'll know several weeks in advance the Cumbre Vieja is about to go berserk again. But then again, will our governments take the warnings of the geologists serious enough if it gets that far? Will they be willing to evacuate the entire US East Coast and large parts of Europe, following the advice of only a handful of scientists? Somehow, Exit Mundi doubts it. Perhaps the Mother of all Waves will take us by surprise after all.

As one researcher (Bill McGuire) put it: "There’s a problem with all major natural catastrophes. Because we’ve never experienced these things, we don’t think that they’re going to happen to us. We just ignore them, but these sorts of events have occurred throughout geological history. They’re not going to stop happening just because we’re around."

VOLCANOS – any day now

And you think the comet that wiped out the dinosaurs was quite something? Well -- it was peanuts, really. Some hundreds of millions of years earlier, a volcano did a much more thorough killing. And the bad thing is: the next supervolcano is about to go boom.

Think of every species of plant and animal you can think of. Now, imagine that nine out of then of them are no longer there. Not much left, right? Still, this is exactly what happened 248 millions of years ago, when the world was struck by the biggest natural disaster known in history. During the **Permian-Triassic extinction**, 90 to 95 percent of all species died out.

No-one really knows what sparked off the event. But according to the leading theory, the killer didn't come from outer space -- but from below, from underneath what is now Siberia. There, a disproportional big volcano popped up. It spewed out enough lava and gas to blow up the planet's climate and reset evolution.

Now there's volcanoes and VOLCANOES. In 1783, the Laki volcano in Iceland erupted, belching up almost five cubic kilometers of super hot lava. Nine thousand people perished on the spot, eighty percent of all livestock was killed, a quarter of Iceland's population was killed in the aftermath, and dust blocking the Sun pushed down temperatures several degrees on the entire northern hemisphere. Now, that's what a geologist would call a **small** volcano, a pimple popping open, really.

How different it was 65 million years earlier, when a volcano made a mess of what is now India. For several centuries in a row, the volcano pumped up something like 400,000 cubic kilometers of molten rock -- the Iceland eruption 100,000 times over! Some scientists still blame the volcano, and not the comet, for the extinction of the dino's.

Obviously, **supervolcanoes** can be, well, a little problematic. Ordinary volcanoes just pinch a tunnel in the Earth's crust. But a supervolcano is a completely different thing. A supervolcano is what happens when pressure builds up in an underground lake of magma. A supervolcano is much like a high-pressure balloon full of lava exploding. When it erupts, it really ERUPTS.

- 'Well... Fancied it would be worse than this'

(Cartoon copyright Exit Mundi/Matthias Giessen)

So, we'd run away, right? Hmm. If only it was that easy. An even bigger problem than the lava itself is the ash. 64,000 Years ago, a supervolcano made a mess of what is now the US. Of the current 50 states, 21 were covered with a layer of ash, at some places was over twenty meters thick!

Well, who cares, you might think - we'd just dust it away. But it isn't that simple. Volcanic ash is not like the ash you find on the barbecue: it is made of tiny pieces of rock. If it falls on your roof, your house can collapse under it's weight. If it gets into contact with cars or airplanes, they will break down or crash. Even worse, if you inhale it, the ash will mix with the liquids in your lungs and form a cement-like substance. You'll literally drown in concrete!

So you'd take a boat to another continent, right? Wrong. Apart from lava, volcanoes spew out a deadly brew of toxic chemicals. There are sulphurous gases that turn all rainfall into a blistering downpour of pure sulphuric acid for years to come. There are all kinds of chlorine-bearing compounds that break down enough of the ozone layer to turn the Sun into a real killer. There's carbon dioxide, the greenhouse gas that not only nibbles at the ozone layer, but also causes long-term global warming. And last but not least, there's soot. A super eruption will darken the Sun, and gradually push the Earth into nuclear winter. For many years, or even centuries, we will have to survive in darkness and cold.

Ok, we may be smart enough to escape from the lava and the ash, dodge the acid rains, survive the nuclear winter and protect ourselves against the killer solar radiation afterwards. But plants and animals definitely are not. We'd find ourselves in an increasingly empty world, as one species after another goes extinct. In the end, even the toughest survivalist would starve to death.

Ash attack! - A supervolcano would turn an entire continent into a poisoned, ash covered shadow world (still taken from 'Supervolcano' by the BBC)

In fact, 74,000 years ago, humanity almost did. In those days, a supervolcano erupted in Toba, Sumatra. Quite a lot of scientists believe this is what pushed humanity to the brink of extinction: it is a well-established fact that in those days, humanity suddenly was reduced to a slim total of some ten thousands of men.

Alright -- but that was a long time ago, you might argue. Well, here's some bad news. Geologists agree that another supervolcano will definitely show up sometime somewhere in the future. It's a bit inconvenient no one knows where it will happen -- or when.

But that's not even the worst part. If you still want to have a good night's sleep tonight, better stop reading here. For actually, the next Magmageddon is due to arrive any day now.

At this very moment, a well-known supervolcano broods its ugly plans right under beautiful Yellowstone Park. On average, the Yellowstone supervolcano erupts once every 600,000 years - but the last time it erupted was 640,000 years ago. Oh, and by the way: in parts of Yellowstone Park, the ground has gone up seventy centimeters during the last century. Also, a lake has flooded,

A consequence of some innocent magma flowing from one place to another? No one really knows. It seems the stage is set for a very nasty surprise.

Wyoming, USA: In 2005, the BBC broadcasted the dramatised series 'Supervolcano', about a not-too-fictional supervolcano eruption Yellowstone Park

Links out:

BBC Supervolcano

Yellowstone Volcano Observatory

The Lake Toba eruption

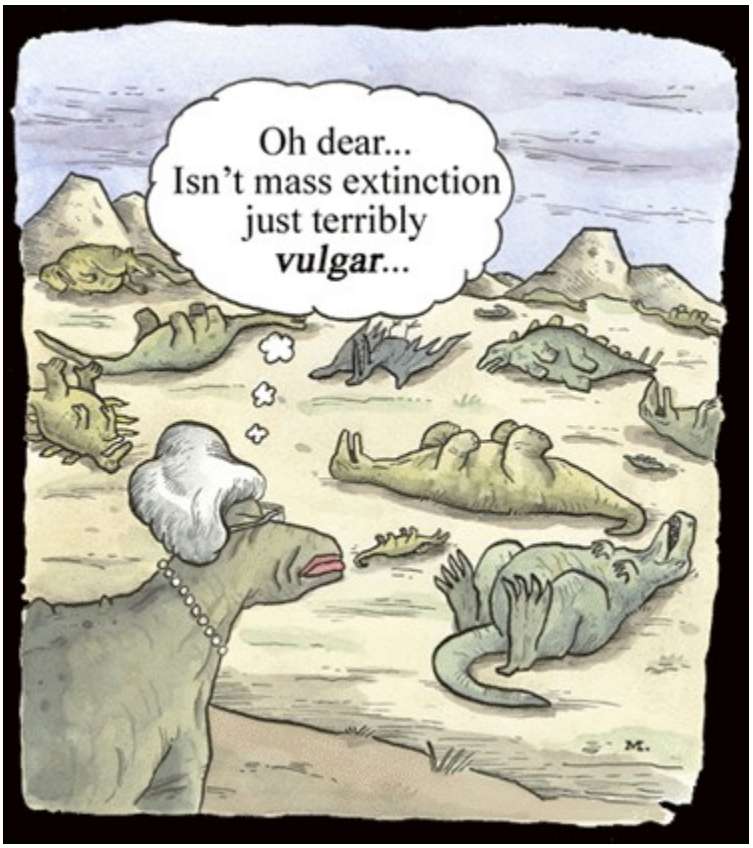
VERNESHOT

If you think you've seen it all, just picture this: your entire country, launched into space. Sounds weird, right? Still, it could happen any day, scientists say. In fact: the country-launching thing may be responsible for the death of the dinosaurs, 65 million years ago.

Not too many people know about it. And perhaps it's better that way. For if a new, bizarre theory has it right, the dinosaurs weren't killed by a meteor impact after all -- but by a much scarier phenomenon, known as a 'Verneshot'.

And that’s not all. If Verneshots are for real, the dreaded phenomenon should happen again one day. Or, who knows, tomorrow.

That doomsday will begin like just any other. But then, suddenly, you’ll hear a big, rumbling noise -- that deep, roaring, earthquake kind of sound. And then, there’s a MASSIVE explosion. It will be a disaster unlike anything ever witnessed by mankind.



(Cartoon copyright Exit Mundi/Matthias Giesen)
[Enlarge image]

The earth literally caves in underneath your feet. Next thing you know, you find yourself falling into this colossal, gaping hole, many kilometers deep and hundreds of kilometers wide. You, your house, yes: your entire country is sucked in. Deep down below, you might just be able to see the red hot flicker of the Earth’s restless bowels.

And if that spoils your day -- just wait. For deep down underneath you, the gaping hole starts to collapse. Starting from below, the crater squeezes tight, like some ridiculously large gullet contracting. Traveling at the speed of sound, the squeezing comes straight at you.

And then, it’s: POP! You’re blasted out of the hole, like a piece of wet soap, catapulted out of someone's hand. And you’re not the only one that is launched. In fact, your entire country pops out, along with tonnes and tonnes and tonnes of rock and soil. The debris -- and you -- fly off into the stratosphere.

Let’s face it: by now, you’re probably dead. But for arguments sake, let’s say you’re not. Next thing you know, you find yourself hovering over the Earth, like some oddball DIY astronaut, sitting on a chunk of debris. You fly and fly, and then, just when you’re beginning to appreciate the view -- oh boy, going doooooooown!

The Earth’s gravity pulls you back in again. You impact on the other side of the planet, together with your entire country. Ka-boom!

And that's the end of it. Or not quite: the planet is a complete mess. Where your country once was, a huge lake of lava, a 'flood basalt', blobs out of the ground. The atmosphere is suffocated with soot and sulfur. The ozone layer is wiped away.

And on the other side of the planet, things aren't any better. Where you and your meteor have impacted, a vast crater remains. A massive shockwave travels across the globe, setting the atmosphere on fire. And when the fires dim, the Earth's climate is plunged into a numbing nuclear winter, because of smoke blocking the sun. Obviously, humanity never stood a chance against this double-whammy. Most likely, everything bigger than an insect dies.

Where No Bullet Has Gone Before: In Jules Verne's 'Journey To The Moon', a huge cannon shoots a capsule to the moon.

But are Verneshots for real?

By now, you probably understand why the German geologists who described the disaster in 2004 named it 'Verneshot'. Jules Verne was the writer who once dreamt up a cannon capable of shooting rockets to the moon. And a HUGE cannon, that's exactly what the Verneshot is. Well, kind of.

But could it be true? Can we really end up on the other side of the planet? Surprise, surprise: that possibility is real. In fact, there's tantalizing evidence that the Earth is struck by Verneshots at least **four** times before.

For starters, you should know that the prehistoric past of our planet shows a very weird pattern. Four times in a row, almost all life on Earth suddenly vanished. Just like that. And scientists just can't seem to agree what did the killing. There's evidence that four huge meteorites banged into our world. But there's evidence that the soot from 'supervolcanoes' choked our world to death, too. (See table)

Event	Meteor evidence	Supervolcano evidence
'Frasnian-Fammian' extinction, 364 million years ago.60 Percent of all marine life dies.	The 'space element' iridium and stressed ('shocked') quartz is found in the ground. The Siljan impact crater in Sweden was	In the Ukraine, a major outpoor of lava forms the Pripyat-Dniepr-Donets highlands.

	formed around the same time.	
‘Perm-Triassic’ extinction, 251 million years ago.96 Percent of all species vanish.	Shocked quartz and rare carbon molecules called ‘fullerenes’ are found in China and Australia. Also, in the seabed near Australia there is a hole that looks like a meteor crater (the ‘Bedout’ high)	In Siberia, a major outflow of lava forms the Siberian Traps.
‘Triassic-Jurassic’ extinction, 200 million years ago.20 Percent of all species die.	Iridium, shocked quartz and a likely impact crater: at Manicougan, Canada.	The Central Atlantic Magmatic Province, off the coast of Sierra Leone, is formed.
‘Cretaceous-Tertiary’extinction, 65 million years ago. 60 Percent of all species, including the dinosaurs, meet their maker.	Well-defined iridium layer, shocked quartz and fullerenes, and a famous impact crater at Chicxulub, Mexico.	In India, massive volcanic activity creates the chain of mountains called the Deccan Traps.
Death Logic: In at least four mass extinctions from our prehistoric past, a meteor impact seemed to coincide with massive volcanic activity.		

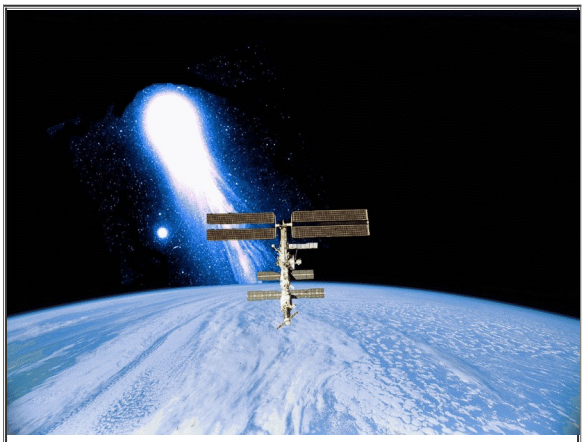
Take the extinction of the dinosaurs, 65 million years ago. Obviously, around that time a huge chunk of rock smashed into what’s now Mexico -- you can still see the impact crater. But equally obvious, there was a massive volcanic eruption in India around that time, too. Now ask yourself: how big are the odds that these two events occur simultaneously? According to the Germans, the odds that volcanism and meteors coincided four times in a row are 1 to 3500.

So bring in the Verneshot. Perhaps the volcanism caused the meteor impact! The German research shows that it could be possible.

Basically, it all begins when deep under the ground, gas seeps up -- a fairly common thing, in geology. But this time, the gas gets trapped underneath what’s known as a ‘craton’: a solid, impenetrable, massive slab of ancient earth crust.

Next to the craton, a HUGE supervolcano may erupt. But the craton itself is in even bigger trouble. The gas has no place to go. More and more pressure builds up. Until one day, the entire craton goes pop - much like the cork blown off of a pressurized bottle of champagne. But this time your planet is the bottle. And you, you'll be the cork!

After the initial bang, you'll have this huge, gaping, vacuum hole in the Earth. Like all vacuum holes, the hole slams shut. From the bottom up, it implodes. A huge ball of debris is squeezed out. The debris catapults into space. And slams back into the planet elsewhere -- just like a real meteorite.



Some suprise: The crew of the International Space Station (ISS) won't believe their eyes, as a huge chunk of the Earth is suddenly hurled into space.

The German scientists hope to find more evidence for their theory, by closely studying the soil underneath India and Siberia -- sites where Verneshots must have gone off in the past.

Worryingly, they have found some evidence to support their case. In Siberia, India and on the ocean floor near Sierra Leone, you can see these weird, circular structures in the ground. They look a bit like, well... the barrels of three huge, ancient cannons.

On the other hand, the Verneshot theory is still new, controversial stuff. For one thing, the theory doesn't explain why there seems to be only one meteor impact crater near Mexico. A Verneshot would throw up more than one 'comet'.

Perhaps it's all the better we don't know. For there's a little problem. At this very moment, pressure is slowly building up underneath the craton of Siberia once again. Could it be just some innocent display of nature? Or are those poor Russians about to get shot in the bum in a way that hasn't been seen on Earth since the days of the dino's?

MASS INSANITY – FROM AD 2020

Is humanity going insane? Although it seems too weird to be true, there are some quite serious clues that the civilized world will one day fade out in mass insanity.

Just picture it: a world full of nutcases. On the streets, you'll see people flapping their arms and shouting they're airplanes. In the president's office, a moron will say: `I wonder what this button does' – and promptly start a nuclear war. Others will kill themselves, jumping from buildings to prove they can fly, shooting each other up for fun, or stepping in front of trains because they think they're Superman. Admit it. It would be a rather odd way of going out.

But actually, the nutcase scenario is not that idiotic. It got high marks on a dead-serious ranking of what can go wrong with the world, published once by the popular science magazine Discover. Indeed, there's some quite serious evidence we're heading for total insanity. We're a more mentally deranged species than ever. And we're going crazier all the time, the figures show. Depression, anxiety, eating disorders – they're all on the rise.

Just look at the figures. An estimated six percent of all men and ten percent of all women suffer from depression. Ten to twenty percent of all kids have some kind of mental illness or behavioral disorder. In the US alone, something like 20 million people suffer from some kind of anxiety disorder. And that's not everything. The World Health Organization expects that by 2020, depression will be the second major cause of disability, right after heart diseases. `Have we entered the age of misery and melancholy?', the Canadian*Journal Of Psychiatry* asked in an editorial.

Sounds hefty, right? Fortunately, there's also a lot to be held *against* the figures. With ever more people on the planet, it's only normal the number of mentally ill should rise too. But way more important, the nutcase number is climbing because of the way we deal with them. Not too long ago, nobody thought anything of it when you went crazy. You just had to cope with it yourself. And if your mental mishap was too conspicuous, well, they simply locked you away.

Nowadays, that's all changed. There are treatments for all kinds of mental inconveniences, ranging from mild depressions to fear of the dentist. In fact, because of the

revolution in psychiatric science, there's a `syndrome' for all kinds of behavior – even the more normal ones. Drinking, having sex, smoking, using marijuana, breaking the speed limit with your car, surfing the internet, being single – our shrinks label all these things as `problems', mental abnormalities that shouldn't be there.

The World Health Organization is no exception. Under their `mental and neurological disorders' they also list smoking tobacco and marijuana, epilepsy and drinking alcohol. Think of smoking and drinking what you will – but is it the same as believing you're an airplane?

Let's face it. In a way, our shrinks are driving us crazy. Or am I being neurotic, paranoid, schizoid, over-aggressive and narcistic to say these things? Hmm, I probably should go see a shrink.

But wait a sec. All that said, the prospect of humanity ending up totally wacko is actually very likely. You read that right: **very likely**! It doesn't have anything to do with shrinks – but with basic biology.

Suppose one of the catastrophes outlined on this site one day really happens. Suppose there's a meteor, a nuclear war, asupervolcano or an all-out ice age. Humanity will be swept away, with only a few pockets of humans surviving. To reproduce, they'll have to inbreed. And if a small group of people inbreed, the species will, after a generation or two, start going sour. They will be malformed, and especially their minds will be severely twisted. It's just nature's way of saying: there's too little of you, you'd better go extinct altogether.

So in the end, if disaster strikes, mental retardedness is indeed the most likely prospect for the survivors. The last humans on earth will indeed run around, flap their arms and pretend they're Superman.

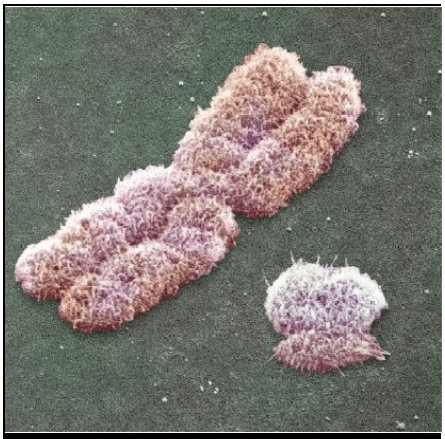
Well, look at it from the bright side. At least, we'll have a lot of outrageous fun before we go out!

XY CONFLICTS – AD 125,000

It’s every man’s secret fantasy: a world, exclusively inhabited by women. Well guys, have we got news for you. One day, the dream could come true! But before you straighten your tie, there’s something you should know. In a world without men... Well, humanity dies out.

Chances are you haven’t noticed it, but there’s a war between the sexes going on. A foul, chemical war it is, a bitter battle to the death. Gladly, it’s a rather small-scale war. The parties doing the fighting are sex chromosomes: tiny, curled-up molecules of DNA that lay hidden within each human cell.

Still, the future of mankind is what’s at stake.You see, it’s a war between boys and girls -- literally. And here’s the latest news from the battlefield: the women are winning. At least, that's what it looks like. The girls are about to wipe the boys from the face of the earth.



X vs. Y: The Y-chromosome already looks tiny and weak compared to the X-chromosome.

As you may know, there are two kinds of sex chromosomes: X and Y. If you inherited two X’s at conception (one X from every parent), you’re a woman. When your father gave you a Y-chromosome, it adds up to XY -- which stands for man. All in all, the Y-chromosome is the thing that makes a man a man. Well, apart from that other thingy, that is.

On Y, you’ll find all the stuff that a man needs. You’ll find genetic instructions for how to brew semen, and how to grow a trunk -- no, a little lower, if you please. If there exists a gene for watching football and telling lame sex jokes, you’ll definitely find it on the Y-chromosome.

But on Y, you’ll also find stuff that is harmful to women. For example: sperm contains chemicals that attack the woman’s body. Really! Semen comes with chemicals that shut down the woman’s immune system, so that it can make it into the womb alive.

That's why X, the female chromosome, hates Y. In response, X is constantly throwing all kinds of wicked chemicals at Y. X is killing Y.

Take a look through the microscope, and you can immediately see Y is in trouble. Y is a tiny, crumpled chromosome -- not exactly a proud symbol of manliness. Ever since Y split off from the other chromosomes, some 300 million years ago, its number of genes went down from about 1,000 to 80. How did it ever get so tiny? You guessed it: that's because of the female chromosome's attacks.

But even without a microscope, the signs are clear. The fact that some people are gay or transsexual could be a direct consequence of the battle between the X- and the Y-chromosome, some geneticists think.

The world to come?

And there are more grizzly clues.For example, every now and then, doctors coincidentally stumble upon a woman who has XY for chromosomes -- the ‘male’ combination. Somehow these ladies' X-chromosomes have found a way to disable the Y-chromosome.

And in 1947, a French hospital admitted a female patient who gave birth to a baby girl. The woman wasn’t the least surprised.**All** births in her family were females, she told the doctors. Scientific investigation confirmed this. Somehow, the family’s genes had found a way to overcome the ‘man-problem’. Her family had learned how to kill Y. And now, the family's women no longer gave birth to any boys.

Perhaps the most spine-chilling clue comes from the men. As we speak, 1 to 2 percent of all men is infertile because of a malfunctioning Y-chromosome! That doesn't seem like much, but it is an astonishing number, because the defects cannot have been inherited (because they lead to infertility). So in other words: 1 to 2 percent of all men have their Y-chromosome disabled during their life!

You don’t have to be a rocket scientist to see where that could lead. A couple of thousands of years more, and Y could be history. Suddenly, you would see the number of men dropping sharply. According to an estimate of the British geneticist Brian Sykes, it could take only 5,000 generations before the world turned into a place almost exclusively inhabited by women.

No, you dirty little sod, that’s NOT a man’s paradise. Indeed; with the numbers of men falling, probably everyone around will be craving for your semen. But it will most likely not be quite like you picture it. Instead of endless erotic nights, think of handing your goody over to the nearest fertility clinic, where the female doctors will

try to impregnate as many women as possible with your increasingly rare sperm cells.

Ladies first: Already, in some families an overwhelming amount of women is born.

They won’t encourage you to start a harem or so. Sex would be an intolerable waste of sperm cells. And besides, you can’t afford risking a heart attack while practicing the world oldest sport. Your semen has become the most valuable fluid on earth now! The women might even decide to keep the last men captive, like a priceless piece of kettle.

And how’s this for your world-without-men. There will be no one to watch the games with. No one to talk about cars with. In fact, there will be no football anymore and no fight movies. You will be heavily discriminated against by all these giggling, chit-chatting GIRLS you’ll see everywhere. It will be a lonely existence. If you’re a guy, that is.

And the obvious downside: in the end, everyone will be dead. Without men, no babies. Without babies, no mankind. So we’d clone ourselves, you say? Well -- not too many people know of it, but the latest scientific insight is that this is very, very problematic. Clones are full of genetic errors, causing them to die early. And it’s still undecided if that’s a problem that can ever be solved.

So: Exit Mandi?

Gladly, the theory with the Y-chromosome is still very controversial. Many researchers don't really believe men will run out of oomph. For one thing, only recently it was discovered that Y has an unexpected defence mechanism against X. The Y-chromosome has made a secret back-up of itself in reverse. It has its key genes tattooed backwards on its own body, so to say. Shoot a hole in Y, and it simply repairs itself by copy-pasting the back-up onto the wound. It seems that the Y-chromosome is less vulnerable than most people think.

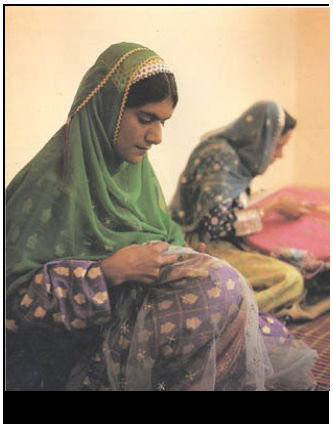
Enjoy while you can: The two-spot ladybird doesn't know this, but it is about to become an all-female species.

On the other hand: the sex chromosome mishap isn't unique. We know of at least three animals where the women are winning. Take the eggfly butterfly (Hypolimnas bolina) of Australia. In the 1970s biologists discovered that most of the butterfly’s offspring is female -- almost half of all males mysteriously die before birth. Exactly the same sinister effect was found for the two-spot ladybird (Adalia bipunctata).

Even more eery is the case of another insect, the buterfly Acrea encedon. As we speak, there’s only 3 percent boy butterflies left, with the

ladies taking on 97 percent of the population -- and rising!

On the other hand, there's the case of a small rodent from Turkey called the mole vole (Ellobius lutescens). Millions of years ago, the X-chromosomes in this animal succeeded in eliminating the Y-chromosome. But the rodent did something remarkable. It evacuated all male genes to other genes. This quirk of nature still astounds biologists. But it also indicates that men in theory should be able to overcome the attack of the girls.



So in the end, what will happen? Nobody knows, the jury is still out. On the one hand, some geneticists point out that X is in the majority.Since women have two X’s and men one X and one Y, X outnumbers the Y-chromosomes by three to one.

But on the other hand, some researchers suspect foul play. Perhaps the doomsayers are only making fun of Y's small size. While having a smaller one doesn't necessarily mean that it won't function. (Yes, yes, I know...)

Still, like most of the scenarios outlined on Exit Mundi, the one with the chromosomes already happened once - almost. Somewhere in our prehistoric past, X seems to have launched a massive attack on Y. It must have been a very close call. But Y succeeded in repairing itself at last. We can tell this has happened because of certain scars that are still detectable on the male chromosome.

Is that comforting, proof that Y can deal with the attacks of the girls? Or has it weakened Y, and should we worry all the more about the next attack? Better keep an eye on those birth statistics, guys...

EVOLUTION – AD 2060 - 2100

It could take several decades, or perhaps many thousands of years. But we can be sure of one thing: sooner or later, the human race as we know it

will no longer be here. Don't panic, it's just good old evolution that's doing us in. Humanity will go extinct -- but who would care?

We'll admit it - we've been fooling you. When we talked of distant stuff like the Sun's death, or the homecoming of Nemesis, we pretended that there will still be people around in the distant future, just like today.

Well, forget it. Whatever inhabits the planet in several millions of years -- it won't be humans. The human race will have been replaced by... well, something else.

It's easy to see why. There's plenty of evidence we are still evolving. Europeans are getting taller. Northern Europeans are becoming more resistant to disease. And although it's controversial, there's some evidence we're getting smarter.

Men of When? - Five looks at the future of human evolution, as foreseen by MSNBC. From left to right: the toughened up Survivalistian, the smart Unihuman, the genetically improved Numan, the Cyborg, and the star-traveling Astran.

Still, we are also 'devolving' -- getting worse at certain things.

Our limbs have become feebler. Our bodies are getting stiffer, and less agile. Our senses, and especially our nose, have deteriorated big time. There's evidence our sperm is getting worse. Our jaws and teeth have decayed over time (that's why we need constant dental care).

That's because evolution is not about improving living things -- but simply, about adapting to the circumstances. And we're adapted to walking, and thinking, and working with our hands. The cost is that we have become lousy tree-swingers, and bad monkeys. Try eating a banana using only your feet, and you'll see what we mean.

Where will this take us in another million years? Nobody knows! It all depends on the circumstances.

Perhaps our brains will continue to grow, giving us ridiculous, enormous heads. Perhaps our planet will one day be inhabited by sentient brains sitting in a wheelchair, who knows?

But evolution could also demolish us. Say for some reason we are forced to live underground. This could, in theory, yield a humankind with no eyes! This is what happened to certain species of cave-dwelling fish.

And it could get worse. Suppose a deadly disease broke out. Now, suppose there was only certain people genetically fit to fight off the disease.

Experts agree on one thing, though. Our kind could transform a lot quicker than you think. We're already tinkering with the evolution of our species, for example by healing the sick. And that's just the beginning. Roughly speaking, there are two trends here: technology and gene tinkering.

1. Technology

Already, we are stuffing up our bodies with all kinds of goodies: artificial limbs and organs, plastic heart valves, titanium joints, contact lenses, hearing aids -- you name it. And no doubt we will continue to replace body parts with high tech gadgets. Already, scientists are experimenting with brain implants that help or even replace part of your brain!

Futurologists expect we will one day upgrade our minds with chips that boost our brain power, or even upload our mind to a computer. Or we would replace our vulnerable organs at birth, just to be sure.

So, how's that for evolution. In a few decades, we may have got to the point where we are no longer humans -- but machines. As astronomer Seth Shostak likes to put it: "You can improve horses by putting four-cylinder engines in them. But eventually, you can do without the horse part."

2. Genes

Or we could upgrade our DNA.

At this very moment, we're entering the age of genetic modification. Already, we're upgrading the DNA of certain plants and animals -- and we, humans, are next. We're about to improve our genetic code, just like you would upgrade an outdated piece of computer software.

At first, this will lead to new cures for certain diseases. We will teach our DNA to fight off hereditary conditions, and in the longer run, viral infections and cancer. But it should also be possible to actually improve our bodies. Sportsmen will instruct

their DNA to make more muscles, a feat already accomplished in animals. Others will tweak their DNA in order to lengthen their lives, or to become smarter.

Ultimately, the sky is the limit. Want bigger brains? Healthier organs? Bigger penises, larger breasts? Just tell your DNA to make it so. And hey, think big! Why not grow yourself wings, enhance your vision or make your body solar powered, so you can do without food?

In principle, it's all possible. Just think of our bodies as computers, the DNA being its software. We're about to upload software from other species. Almost every trick nature has ever programmed into DNA software in other species, could be running on our bodies soon. It's Mother Nature's freeware!

So, where will it take our species? Our guess would be: to a point where humans are no longer human. Scholars expect 'Numans', 'Transhumans', 'Unihumans', 'Astrans' -- and lots of other shiny sci-fi words. It will be the end of mankind. But with some luck, it will at least be a happy end!

MASS SUICIDE

Now here's something different: what if we all killed ourselves? We agree: after all we've been through as a species, mass suicide would be a ridiculous way to go. But oddly, suicide could also be the inevitable, most logical outcome of evolution...

Mass suicide. Oh, come on! What on Earth would we do *that* for?

Well: somewhere in the distant future, we might come to the conclusion that it's the best thing to do. The only thing that makes sense. We would decide to kill ourselves -- and do it. We'd kill ourselves collectively, to the last man. We wouldn't even leave a suicide note. After all, who would read it?

Of course, it won't happen tomorrow. First, a lot of dramatic changes will take place to our species. Right now, we're not too keen on dying. In fact, we hate it when we die!

But most scientists expect that over time, this will change. Slowly, we will defy death. We will beat disease after disease, and live longer and longer. We will fool the Grim Reaper with anti-ageing chemicals and fantastic, new cures.

And in the end, we will beat Death. We will need all our technological know-how to do it. In the long run, we will replace our entire bodies by technology. Already, we replace our teeth and the occasional limb that has gone missing with artificial stuff. In the near future, science expects to invent replacements for our organs. A little later, and we will be able to replace our brain by computer technology. Really! Already, some futures researchers expect that by the year 2050, we will be able to upload our mind into a computer! We will become machines-- and be immortal.

Trust us: it's gonna be fun. When our minds have become pieces of software, we will be able to copy ourselves! We will be able to upload ourselves to... well, whatever we like. We will go out in space, in the shape of a conscious space ship. Or in the form of a purple cloud of thinking smoke particles. No, seriously! Respected scientists like Freeman Dyson and Carl Sagan already wrote about this in the 1970s.

And we will interact with each other, big time. With our biological bodies gone, we will no longer need MSN, Hyves or Myspace to get in touch with each other. Rather, our minds will start to... well, blend, actually. We will become one consciousness. Some researchers have dubbed this The Singularity, as we detail elsewhere on this site.

Ok, that sounds pretty vague -- but hey, it's no reason to kill yourself! Well: there is this one crucial detail. Once we're immortal, we'll be booooooored!

To us simple, mortal humans this may be a bit hard to grasp. But once we've reached Perfection and Singularity and Oneness and all that blah blah, we will have no goal in life. Yes, we will go out and discover the Universe. But after a while, we will have seen it all. With our mortal bodies gone, we will have all the time of the Universe. We will know every corner of the Universe and say: so what? Why search any further? To an intelligent cloud of smoke particles, searching every corner of the Universe will make as much sense as examining every blade of grass on Earth makes to us.

So there you have it. You've become a God-like purple space cloud, but now you find that it is soooooo depressing.

And in fact, it's even worse than that. Once we will become machines, our processing speed will increase hugely. Simply put, we will think bloody fast. Within a split second, we will realize that our existence, literally, has become useless. A split second later, we will realize it's best if we didn't exist.

- **Brothers, Kill Thyself** - In the Japanese cult movie Suicide Club (2002), people commit mass suicide. In reality, mass suicide could be the natural outcome of evolution.

To a Purple God Cloud suicide will be as self-evident as tossing away a used scrap of paper. As logical as getting off a train that has reached its final destination. And the final destination is what we will have reached: the endpoint of evolution.

Even harder to comprehend, the God Cloud won't have any special feelings about it. When we think of suicide, we immediately think of terrible things with high buildings and shotguns. But when you're a Purple Cloud, it's all very different. Conscious clouds don't feel pain and have no reason to be afraid, least of all of death.

If you're immortal, dying might seem like a fun thing to do! It will be as challenging as it is for us *not* to die.

So, there we go. After a long period of contemplation -- say, an entire millisecond -- we will realize we have become useless. Right there on the spot, we will kill ourselves.

And hey, you're doing it again! You picture a purple cloud, desperately weeping, throwing itself in front of a speeding train. But it won't be like that at all. Rather, we will terminate ourselves in some way yet beyond our imagination. We will step out of the Universe, fold ourselves up, switch ourselves off -- something like that. In a split second after we've reached immortality and Oneness and all that, we will be gone. Click. Puff. Exit.

The Games Alternative?

So -- is that it? Is suicide the inevitable outcome of evolution? Well, actually: there is at least one other way out. But this route is so strange and so disturbing, that it will blow your mind. For your own sake, we ask you: if you're mentally unstable or if you have a history of psychiatric disorders, please don't read any further. It's at your own risk.

For what else is there to do if you're a Super Bored Super Human? What do *you* do when you're bored? Indeed: you distract yourself. You play a video game, go out, or watch TV.

Exactly this is what a superhuman intelligence may do as well. But of course, it will seek distraction in a superhuman way: it will create a new Universe, break down its intelligence into bits, and seed the new Universe with the spores of its Presence. Basically, such a ‘game’ will be a Universe that is destined to bring forth life and intelligence.

But wait a minute... Isn’t that exactly the kind of Universe we’re living in?

As we outline elsewhere on this site, it is. Scientists have noticed for long that our Universe looks chillingly artificial. The way its parameters are set, and the way it is functioning suggest that something or someone has tinkered with it. Everything we see and feel and experience - it could be an illusion! We may be part of a kind of Sims Game, played by some kind of Superhuman intelligence...

It would get weird when we reach Superhumanity again. We’d ask ourselves: "Ok, what’s it gonna be? Another game of Universe? Or should we kill ourselves now?"

LINKS OUT:

David Smith: "2050 -- and immortality is within our grasp" (The Observer, 22 May 2005)

Freeman Dyson forecasts the future (New Scientist, 16 November 2006)

PAPER SOURCES:

Ray Kurzweill, The Singularity is Near (New York, 2005)

[SCIENCE]

THE BORG – AD 2040

"Resistance is futile". If you're a Star Trek fan, hearing those words probably immediately triggers one thought: the Borg. The Borg is the ultimate nightmare: humanity, enslaved by a computer. Luckily, it is only fiction. Or is it?

In Star Trek, they come in a cube. A huge space ship it is, filled with millions of people. Well -- they're not really people. They are the Borg. The people in the cube have no free will, no mind of their own. They are One. They're plugged into the mainframe computer called 'the Borg'. They're cyber slaves. Poor little creatures.

But that's science fiction, right? Not so. In fact, as we speak, the Borg is lurking just around the corner, waiting for its chance. It won't come in a cube from outer space though, but from the very place you're on right now: the Internet. And if it comes, resistance will, indeed, be futile.

The signs are disturbing. Let's do a little experiment. Please, find out what 'auparishtaka' is.

Done that?

Ok, all of you readers have probably followed exactly the same routine. You've opened Google and entered 'auparishtaka'. All of you will have found the same search results. You will have visited the same websites. Have absorbed the same information. For a very brief and fleeting moment, you were One.

Silly example, you snort.

But hold on -- that was just to warm you up a little. The real stuff is yet to come. Brace yourself: what you are about to read, could change the way you see your humble computer and the Internet forever.

One: We are being cyborged

Already, there are many experiments with simple implants being inserted into people's brains. Most of them are there for our health: the implants bring back (some) hearing or even some eyesight, or cure you from terrible conditions like depressions or extreme phobia's.

But some implants have a more 'luxurious' function. They connect to your brain in order to make you move your artificial limb, if you happen to be missing one. Or they make you control the cursor of your computer by mind control, if you're paralyzed.

Most experts agree that that's just the beginning. Eventually, we will see more and more implants. Need to learn Greek? Just have a cyber

doctor plug a tiny chip into your brain, much like a memory stick. Want better eyesight? The doc will upgrade your visual cortex a bit, Vision 2.2. And so on, and so on.

Of course, these are exciting, good things. But there’s a downside. Computer hardware isn’t going to be the only thing that’s entering your brain. Along with it, the Web enters your mind.

Two: We are being assimilated

In small, high-tech countries like Singapore and The Netherlands, the Internet is everywhere you go and everywhere you look already. Gaming, shopping, dating, e-mailing, working, reading about the end of the world -- it’s all done over the Internet.

And the Web is still on the rise. Not only is it on ever more home computers. As we speak, it is entering our TV-sets. It is conquering our laptops and our cell phones. It is sneaking into our car computers and household machinery. In fact, the Internet is about to incorporate every device we associate with ‘communication’.

It is only likely the last ‘device’ will be us. Of course, the computers implanted in our brains will be connected to the Internet. The advantages are just too big not to let this happen. We will have Internet in our ears, and Internet on our eyes -- literally. Our brains will be permanently online.

So, you think of ‘aupraishtaka’, and instantly know that it is just another word for… Ehm, yes, that. You think of your auntie in Timbuktu, and your auntie thinks back at you, setting up a telepathic chat session, brain-to-brain. You think of captain Jean-Luc Picard, and his photograph will instantly pop up in your mind's eye. It is sent straight into your visual cortex, where it is translated into ‘image’ by your brain. You can hear Jean-Luc's voice saying ‘Make it so’, if you like, or think up information about the actor playing Jean-Luc, and what movies he’s in. Convenient!

That's pretty difficult to imagine, don't you think? Well -- it gets a bit weirder. With your brain online, ‘you’ will no longer be exclusively ‘yours’. You will, in a way, become a local cache for the Internet. Your brain will become the Internet’s work memory. And that’s where things turn, well… pretty nasty.

Three: We are being Borged

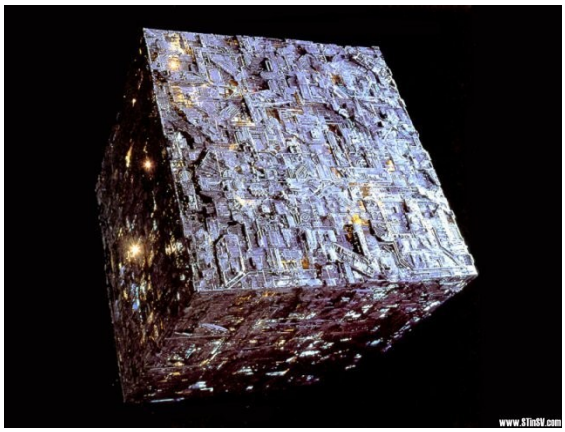
So, here you are. You’ve got a computer plugged into your brain. Your mind is online all of the time. You’re one smart cyborg, that’s what you are!

But what is online, is vulnerable. Someone could actually hack your head. Some evil genius could virus your mind, or spyware your thoughts. We can agree on one thing: that would be, well, more than a bit confusing.

Probably the biggest danger are viruses that build themselves.Already, there are many experiments with software that becomes smarter -- software that evolves, by constantly improving itself. With every inhabitant of the planet online, such a virus will have at its disposal plenty of calculating power.

It is speculative, but perhaps you could call a virus like this ‘alive’. Perhaps you could say it has a will of its own. You might even call it The Borg.

So, just picture it: one moment, you’re doing fine -- and then, suddenly, you loose control. In the mild case, you’ll start having weird, uncontrollable hallucinations. You’ll hear some internal voice telling you that resistance is futile, or you will experience some reality that isn’t there. You will go insane. In the more extreme case, you’ll suddenly find your body is no longer under your control. Somebody -- or something -- is controlling you, like a puppet. You will have become a prisoner, locked up in your own body.



The Borg might order you to do all kinds of things. For starters: to eliminate everyone who isn’t assimilated yet. Against your will, the Borg will force you to hunt down everybody who hasn’t got an internal brain computer. You will be forced to operate on them and turn them into cyborgs, too. So there you are: suddenly, you find yourself operating on somebody’s brain -- without neither your nor the patient’s consent.

Perhaps the Borg will even order you to build a cube-shaped space ship and go out, in search of more life-forms to assimilate. To the Borg, more slaves means: more calculating power.

So: to Borg or not to Borg?

Perhaps you shrug your shoulders. Really, how bad can it be? People being assimilated by the Internet... C’mon, that’s just too much.

Then again -- maybe it isn’t. Remember the Internet as a mass medium is only some 10, 15 years old. That’s less than 0,001 percent of the time our species is around on this planet! Already, computers and the Internet have totally re-shaped our world. And we can be sure of one thing: it won't stop there.

Of course, the Internet, as it is now, has little to do with Borgs and cube-shaped space ships. It is as dead as a doornail. It doesn't 'want' anything. The Web is still just a bunch of bits and bytes, sitting passively on hard disks around the world.

But the self-learning software we mentioned before could change all that. Say, we'll make a self-learning piece of software that has one assignment: "Find a cure for cancer". Actually, software like this already exists: it is software that automatically checks certain molecules to see if their shape is suitable for curing cancer.

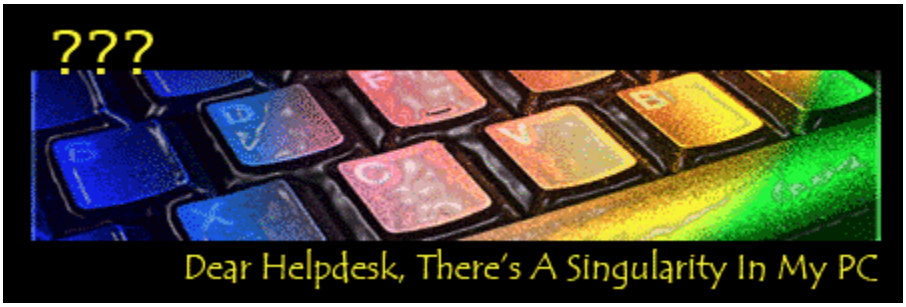
Ok, now suppose this software gets smarter. It could find new, creative ways to do its task. Like: "Hey, let's enslave all these silly little humans. Let's force them to build a giant cube and go out in space to look for a cure for cancer!" Aw, that would be so dumb...

Still, there's one small straw of hope to cling on to. Nobody can foresee the future. The Borg Problem seems realistic. But so do other scenarios. Perhaps we will be able to erect some kind of advanced firewall between our computers and the thing we call our mind. Or perhaps we will be able to see the Borg coming, and manage to stop it in time.

And if we don't... Well, there's always this. Perhaps going out in a cube and monotonely saying "resistance is futile" to everyone we meet will turn out a funny thing to do after all. We will see all the corners of the Galaxy, scare the shit out of everybody we encounter, know what 'aupraishtaka' means and find a cure for cancer.

Really, being the Borg isn't all bad.

SINGULARITY – AD 2030



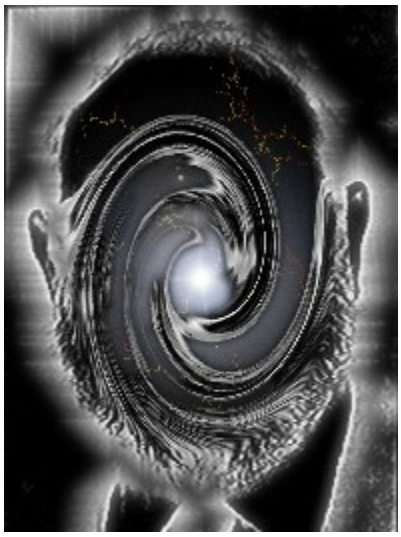
And then, there's always the weird and quite surrealistic end of humanity called 'The Technological Singularity'. It's a concept from computer philosophy, really. But we could be en route to making it real...

It should happen some time over the next thirty years. Suddenly, something very weird will happen. We will vanish into a maelstrom never experienced by any living

creature before: the Technological Singularity. And the really bizarre thing is, we can’t tell you what it’s going to be like. That’s the problem with singularities: they are, by definition, out of reach of our imagination.

There are a few things we can be pretty sure of. Obviously, a thing called 'Technological Singularity' has something to do with technology. It should be dramatic, hefty and sudden. Oh, and you might be interested to hear it should wipe our kind off of the face of the planet.

‘Singularity’ is a word from mathematics. Roughly speaking, it is a place where mathematical order becomes chaotic, where regularity becomes illogical and unpredictable. You cannot even properly call a singularity a ‘place’. It is just that: a singularity. For example, a black hole is a singularity. In it, time collapses and the laws of physics no longer apply.



In the 1950s, mathematician John von Neumann predicted our society is destined to go singularity, too. His line of reasoning was simple: we’re inventing things at an ever faster pace. Faster and faster it goes, until one day, the trend explodes. We will invent new things infinitely fast. We and our inventions will... ehm, go out of control.

Read how novelist and mathematician Vernor Vinge put it in a famous 1993 paper: "This change will be a throwing away of all the previous rules, perhaps in the blink of an eye, an exponential runaway beyond any hope of control." And: "We are on the edge of change comparable to the rise of human life on Earth."

If you think that sounds pretty vague -- we agree. Gladly, Vinge also helpfully pointed out a few ‘omens’ that should announce the Singularity. You can see some of them around already. As Singularity Day comes, computers get ever faster, and huge computer networks arise. More and more tasks are automated. Information and ideas spread ever faster. Slowly, humans will begin to merge with their computers, finding new ways to connect our minds to our computers directly. We might even genetically engineer ourselves, or find other ways to upgrade our intelligence.

And then? Next thing you know, some kind of superhuman consciousness awakens. Out of the computers, and out of us, ‘something’ arises. It is something superhuman; something super intelligent. Before you know it, It begins spewing out ideas and theories, infinitely fast. Also, it finds ways to make these ideas real at a similar, infinite speed.

Most likely, you're sucked up in the process, in some unimaginable way. Around 2030, you're tied and bound to the computer, remember? You'll have an interface in your brain to control your computer, or your brain *is* a computer. So probably, your mind suddenly goes Singularity, too.

And after that.. Well, we can't tell. Perhaps we will leave our bodies. Maybe we will merge with our computers, break down the barriers of our individuality and become a train of thoughts. Maybe we will become a duck-shaped cloud of purple gas, who knows? Maybe we will overcome the restrictions of the dimensions, and become God. Now that would be pretty strange indeed, wouldn't it?

To us, living beings, the Singularity should be bad news. After all, if Von Neumann and Vinge are right, there won't be any humans around anymore in 2030. More likely you will find an empty planet. Deserted buildings, empty streets. Perhaps you won't even find a Universe anymore. We even might have terminated the Universe, while going Singularity.

But at least, will it be good or bad? Well -- guess what: we can't tell. In a Singularity, 'good' and 'bad' probably will have lost their meaning. Our kind could end up in a state we today-lings would call 'god-like'. Or, depending on your point of view, 'insane'.

So... Can we avoid it?

Well, maybe we can. For one thing, there's always the possibility that Vinge and Von Neumann have got it all wrong. Maybe there won't arise any superhuman consciousness out of our computers. This is how the great mathematician Roger Penrose saw it: in his view, machines simply cannot become conscious. Period.

What's more, instead of accelerating, our technology might in fact be slowing down. In 2005, physicist John Huebner studied the rate of technological innovation, by counting the number of patents and major inventions per world citizen. The outcome: the speed of innovation is declining! We're simply running out of new ideas. We did the major inventions like the telephone and the airplane already -- and now we're just doing the small stuff, making minor adjustments to our big ideas.

Even if we're heading Singularity, we may be able to isolate the danger. Or hand our computers down a strict order: "Whatever you do, computer, don't mess with humanity."

But actually, we at Exit Mundi aren't too sure that will help. After all, a superhuman intelligence is no match for an ordinary human being. Most likely, it will drag our kind along, into the Singularity. Hey, it might even be fun! Think of it this way: at least we won't be bothered by minor little discomforts like death, when Singularity Day arrives and we become 'Post-Human', or more of that vague stuff.

On the other hand, as you can read elsewhere on this site, there are some hurdles to take first. For one thing, our technology could turn against us beforehand, turning us into the Borg, or ridding the planet of humans. Why, after all, would a superhuman intelligence take us into account any more than we humans feel sorry for a microbe?

Now that would be a bummer. Finally, we're becoming God -- only to find ourselves killed by our machines, only moments before we succeed.

LINKS OUT:

Vernor Vinge, "The Coming Technological Singularity"

Answers.com: "The Technological Singularity"

PAPER LINKS:

Justin Mullins: "Whatever happened to machines that think?" In: New Scientist, April 2005

Ray Kurzweil, "When Humans Transcend Biology" (2005)

OIL PEAK – AD 2008

Look around. See that world out there? Well, it is about to change - forever. Think of wars, famine, diseases and worldwide turmoil. That's what's coming down, as we pass a nasty spike in the statistics called the 'Oil Peak'. In fact, we may just have passed it already.

They call it 'Economic Hiroshima'. And frankly, that's an understatement, suggesting just a local catastrophe that will be gone soon. Well: not this Hiroshima. It will last many decades and change our world forever. An it will not only affect the city of Hiroshima. The impending crisis could throw the entire globe back into the Middle Ages.

And in fact, that's not even the main reason why the Oil Crash is one of the ugliest scenarios you'll find on this site.

So Depressing: During the Great Depression of the 1930s, many middle-class families were forced to abandon their homes and live in slums.

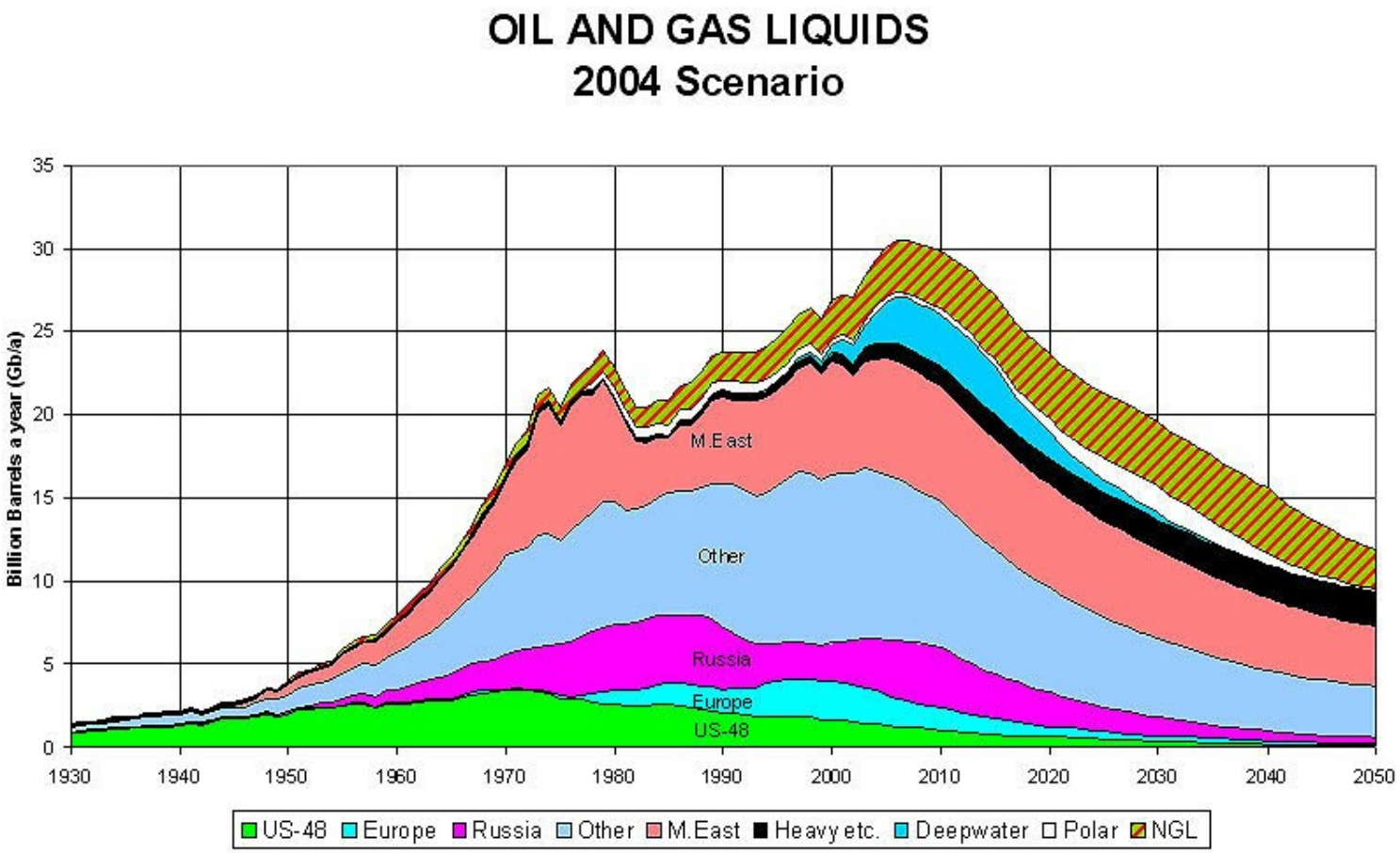
The real bad thing is that the Oil Crash is going to happen. Period. Left-wing and right-wing; conservative and progressive; scientists and politicians: ALL agree that the crisis is inevitable. In fact, the Oil Crash may have begun already. As we write this, the US has conquered the oil well called Iraq and the oil price is at an all time high of over 40 dollars per barrel. This looks bad, folks...

It isn't hard to explain what the trouble is all about. The 'Oil Peak' is the point where the world's oil supplies are exactly half used up. Yes, I felt some relief when I heard that for the first time, too. Apparently, after all these decades of industries and cars, we've still got half of all our oil supplies left! Put precisely: we started out with an estimated total of about 2 trillion barrels. And in 2003, some 900 billion of it had been used.

But there's a downside. When an oil well is half empty, you'll have to go through an increasing amount of trouble to pump the last bit up. Think of it like eating yogurt out of a carton. At first, you'll have no trouble to bring out spoonfuls of yogurt at all. But after a while, you'll carefully have to maneuver your spoon around along the sides and corners of the carton to bring the last bit out. In oil wells, it goes the same way.

So when half of all oil in the world is up, the price per barrel will begin to rise. The prices will steadily go up, with about 1,5 to 3 percent a year. But meanwhile, world demand for oil is on the rise, too. Currently, the entire world consumes about 75 million barrels a day -- or 25 **billion** barrels per year. But in ten years time, demand is expected to rise by more than two thirds, to 135 million barrels a day.

Obviously, there's a gap here. We'll have an oil crisis. According to some estimates, the price of a barrel of oil will increase, don't look now, **five-** to **six-**fold in only a few years time, to prices up to 200 dollars per barrel! This will unleash a worldwide economic crisis beyond imagination, making the Great Depression of the 1930s look like a fun time.



Peak-a-boo: The Oil Peak according to a recent prognosis of the Association for the Study of Peak Oil. Note that the US, Russian and European oil supplies have 'peaked' already years ago. After 2008, the global crisis kicks in.

The real problem, of course, is that our society is addicted to cheap, abundant oil. Our cars, airplanes and ships run on oil. Our electricity is generated in oil-fueled power plants. The stuff you buy in the stores is brought there by trucks that run on oil. In the end, literally everything is to some degree ‘made’ of oil!

So when oil gets expensive, so does our world. Even seemingly innocent things like socks, drinking water and bread will become very expensive. Factories and businesses will go bankrupt. Unemployment will explode, pushing up the state deficit and deepening the crisis even more. Banks will shut down, thereby killing the savings of their clients. In the end, the Oil Peak will send massive shockwaves through the world’s economies.

If you’re an American, your problems are even worse. The US economy is particularly vulnerable to oil problems, not just because the US consumes so much oil, but also because the oil trade worldwide goes in dollars. Consequently, when the oil trade hampers, the US economy takes the punches.

But you don’t want to live in one of the developing countries, either. South-America and Africa are very vulnerable to an oil crisis too, because their economies are weak as they are already. The Peak Oil will trigger an instant and sharp crisis in the Third World, causing even more wars, famines and deaths.

Bad Bank: A policeman guards a bank against looting. In the 1930s, many banks went bankrupt, destroying the savings of many families.

Wind stuff

So if it’s all that bad, we’d just turn to some other kind of energy, right?We’ll have wind mills, and solar cells, and everything will be cool again, you say. Well -- actually, that won’t work. The problem is that at the moment, there just are no real alternatives!

Take wind energy. Wind is obviously stuff that doesn’t contain a lot of energy -- just compare slamming your head into a bit of wind with slamming it into a concrete wall. And what’s more: to build wind mills, you’ll have to weld steel, drive all kinds of stuff and engineers around in trucks and cars, build factories and make

thousands of components. In the end, it costs more energy (oil) to actually build a windmill, than a windmill will ever generate during its entire lifetime!

Roughly the same goes for other so-called ‘alternatives’, like solar cells, hydrogen energy, biomass energy and what-have-you (for the details, check the Q&A below). They all cost more energy (oil) than they produce! The only realistic alternatives are gas and nuclear power. But gas runs out too, and it doesn’t help that we are closing down many of our nuclear power plants.

Nuclear fusion, perhaps? Indeed, that would be a clean, good alternative to oil. But the problem here is, the technology just isn’t ready yet. We need to do more research. After all, you don’t want to risk blowing up part of the planet in an all-too-hastily done fusion experiment. "You wanted energy? Here, have some!"

And of course, even when it comes to alternatives, we’ve still got this world here that is hooked on oil. Our cars run on gasoline, not on electricity. So we need to replace all of our cars and rebuild and rewire most of our society first, before we can use nuclear fusion or nuclear power. And that takes a lot of, uhm... the black stuff.

The cavalry and we

But hold it now, you say: we’ve faced oil crises before, haven’t we? Indeed, in 1973 and 1979, the flow of oil hampered too, plunging the world economy into crisis instantaneously. But back then, it was all easy. Venezuela just pushed up their oil production a bit -- and presto, cheap oil was back again. This time, it is all different. Once we’ve passed the Oil Peak, there will be no cavalry to help us out. Every oil producing country faces the same problem. We’ll have to go cold turkey on our oil addiction. That's just the way it is.

- **The Future?** - The Great Depression was nothing compared to the crisis to come.

By now, you probably see how immensely complicated and big the problem really is. And we have only given you the broader picture. We haven’t detailed the wars and turmoil the Oil Peak will inevitably unleash. We haven’t elaborated on the fact that all the experts agree we won’t find any new oil fields.

The question is not if, but rather WHEN the crisis will strike.The ever-optimistic oil industry says it will last until approximately 2020 -- giving us some head start, to test those nuclear fusion stations and replace our cars. But most

economists think we will reach the Oil Peak sometime over the next few years -- before 2010. The leading Association for the Study of Peak Oil (ASPO) calculates 2008 will be the year.

But in fact, there are some disturbing signs the crisis has begun already. Obviously, the oil price is in trouble -- just read the newspapers. It goes up and down, and up and down, like a rollercoaster. This is exactly what the experts predict would happen right before Peak Oil.

Oh, but surely, there has to be SOME way out? A comforting punch-line, or a soothing, concluding remark? Actually, even we at Exit Mundi are at a loss. Looks like we have to brace ourselves and face the Big One this time. We'll see death and destruction, and see our world change forever. Can't say we're looking forward to it, either.

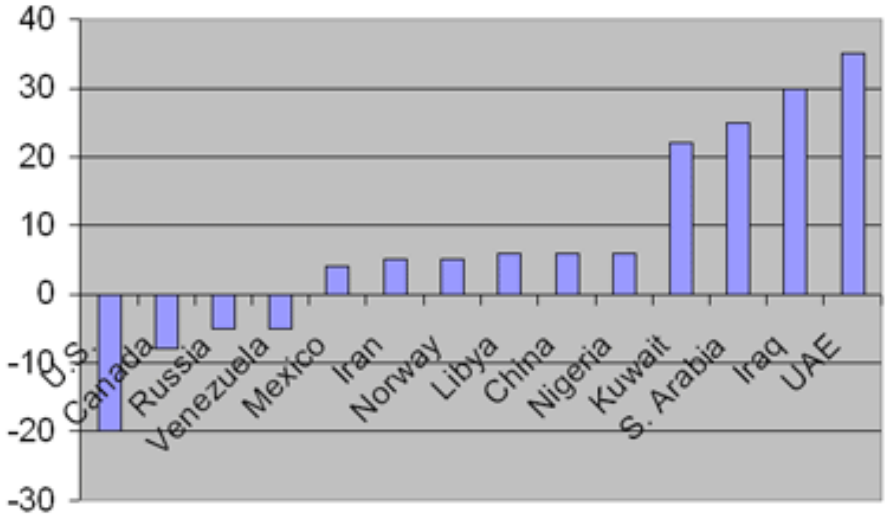
And even then, we'd have to have some luck. There's a particularly nasty glitch in the theories even the economists don't know about. For in fact, the biggest risk we're facing is not even the Oil Crisis itself -- but rather, the invention of some kind of new energy source!

Say we all stop using oil tomorrow. That would mean that suddenly, we will stop putting huge amounts of carbon dioxide into our atmosphere. Now, this is probably **not** a good idea. Over the years, we've got huge amounts of green plants, plankton and algae on our planet, courtesy to the greenhouse effect. If we suddenly stop producing greenhouse gases, these plants and algae will suck all of the carbon dioxide out of the atmosphere.

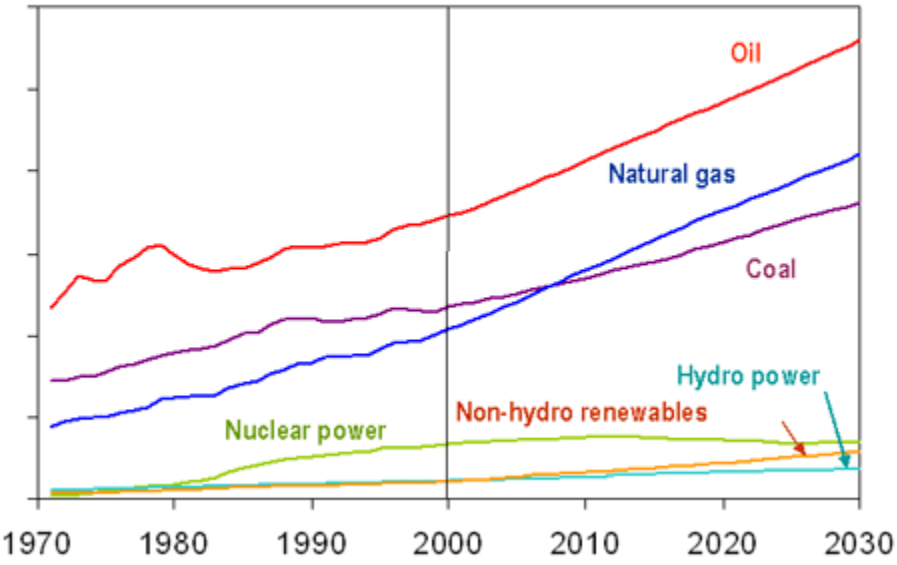
This will kickstart an instant, all-out Ice Age, as our planet is robbed from its protective carbon dioxide 'coat'. The Earth would freeze over. It would turn into a huge snowball.

Now, who wants to have an Ice Age without any heating tokeep us warm?

> Economic Hiroshima in Graphics
> We find economic figures just as boring as you probably find them - but if there have ever been a few graphics you should have a look at, it are these!



Years from Peak Oil: This graphic displays per country the estimated years before reaching their Peak Oil. Note that the US peaked 20 years ago already, and that even Iraq's supply will peak in 30 years time.



Running on empty: The expected demand for oil, gas and other energy resources. We'll need ever more oil, while nuclear power loses terrain. 'Non-hydro renewables' is a difficult way of saying wind energy, solar energy, biomass energy and other stuff like that.

Here at Exit Mundi, hardly a day goes by without e-mails concerning the Oil Peak Problem. Here are some of your proposals and questions - and our answers.

	No, bad idea.
Ok, so we'd build lots of **wind turbines**, right?	As we explained above, windmills are in fact very energy-inefficient. It has been estimated that if you wanted to replace all of the UK's energy for wind, you'd have to build a vast, kilometers wide park of windmills that literally surrounds the island! More technically, the problem is that the power a wind mill generates is proportionate to the third power of the wind speed. That's quite a mouthful, but simply put, it means that when the wind speed halves (say, from 6 Beaufort to 3 Beaufort), the power goes down not by 1/2, but by 1/2 * 1/2 * 1/2. That's an amazing 88 percent less power! And you can't simply build a better wind mill. The 'power curve' is a physical property of wind. It is just how wind works! The consequences of this are dramatic. A good, modern wind turbine only really generates electricity between wind forces 4 and 7/8. Less wind, and the mill will hardly generate any power at all (because of the power curve). Go above it, and the power will get so big, the wind turbine will have to shut down, to prevent damage. The bottom line is this. On average, a wind mill only generates something like 16 percent of the power it should produce! So when you see a wind mill that has a tag "One megaWatt" on it, it only does so under ideal circumstances. On average, it only produces 160 thousand Watt. (Source: Dutch research, in: J.J. Halkema, "Windmolens, feiten en fictie")
I see, no windmills. **Hydrogen**, then?	Little chance.

	Hydrogen indeed a cheap, clean source of energy. But there's a catch: you can't find it anywhere on Earth. You will have to make it first, by splitting up water (H2O) into hydrogen (H2) and oxygen (O2). And that costs you... yes, energy. This makes hydrogen nothing more than a modern battery. You invest energy in making it, and after a while, you tap energy from it again. But like every battery, it won't magically give off more energy than you put into it in the first place. And that's not everything. You will have to store your hydrogen somewhere. This means you will have to compress it into a high-pressure tank. Those tanks are heavy, and the compressing costs you... energy. So if you add things up, hydrogen**costs** energy. It doesn't **generate** it.
But why the fuss over**hydrogen powered cars**then?	The basic idea behind it is that you use wind or solar energy to create the hydrogen. This would give you a clean source of fuel. But as we explained already, that trick doesn't work. It has been estimated that oil would have to become twice (!) as expensive, before the hydrogen economy would begin to pay off.
Ok, ok... But hold it, you said '**solar energy**'. Isn't that an option?	Right now, it isn't. Solar cells aren't just good enough. At the moment, you need the area roughly the size of six ping pong tables to power a car. And of course, you need daylight to power up your batteries.

	And: what goes for wind mills also goes for solar cells. It costs lots of energy to make them. And energy is oil. No, not quite. Orimulsion is another fossil fuel, made of bitumen. And indeed, there's an estimated supply of it of about 1,2 trillion barrels. Even better: you can quite easily turn it into petrol, and use it to generate electricity.
I've heard of a stuff called '**orimulsion**'. There seem to be vast quantities of it. And it's almost the same as oil. Is that going to work?	But that was the sunny side. In the 1980s and 1990s, several power plants tried orimulsion. But they were shut down, because refining and burning orimulsion is very, very dirty. Orimulsion contains up to 2,9 percent sulphur. This ends up as sulphuric acid in the atmosphere. That gives you HUGE problems, like global warming, acid rain, dangerous smog and global dimming. No wonder orimulsion has been nicknamed "the world's dirtiest fuel"! You really don't want to use it.
Hey, I've got an idea! Why not go back to using **coal**? Hitler's Third Reich ran on coal entirely, was it not?	True. Indeed, the estimated supply of coal is 2 trillion tons. And yes, you can wrench oil out of coal. In fact, as we speak, about 23 percent of all energy of the world comes from coal. But the down side to this is that coal will run out eventually, too. Some say it will last 18 years, others say longer. And that's not all. We'd have to adapt many of our factories and power plants and refineries, which would require HUGE investments. And then, coal is another very dirty fossil fuel. It chokes up the

	atmosphere even more than oil does. Useless.
How about 'heavy oil', **tar sands**?	Most of the world's oil is 'dirty' - it is mixed up with clay, sand and other stuff you cannot burn. And indeed, you can purify oil out of it. But: out of one truckload full of tar sands, you will get only about half a barrel of oil. That's not exactly what we would call 'making a profit'. In fact, since trucks and drilling machines run on oil too, you'd have to work really hard to actually 'gain' oil. This definitely won't bring back the cheap oil. That will only ease the pain temporarily.
So, we'd go back to good old**nuclear energy**, right?	Indeed, nuclear power plants offer a steady, very reliable and relatively clean energy source. Ok, the downside is that every now and then, nuclear power plants tend to go kaboom, like they did in Harrisburg and Chernobyl. And then, there's the waste: radioactive mud, not to be touched for several hundreds of years. But perhaps, we're going to have to take problems like these for granted. The bigger problem is that nuclear power plants run on very special stuff. You will need to collect enough of the rare element Uranium, and carefully select the 0,7% of it that is Uranium-235 (the rest is another isotope, Uranium-238, which is useless). Or you could use Plutonium-239, an even rarer element. What's more, Uranium and Plutonium will be up in the end.
And how about that other nuke thing, '**nuclear fusion**'?	That might help -- but it doesn't exist yet.

In 'common' nuclear energy, you split an atom and tap the energy. In nuclear fusion, you squeeze atoms together to make new ones, and tap the energy. That's exactly what happens inside the Sun.

Indeed, fusion energy is much cleaner than ordinary nuclear fission energy. But there's a downside, too: every now and then, you'd have to replace your entire factory, because it has become radioactive. Nuclear fusion turns factories into radioactive waste.

And did we mention the technology doesn't exist yet?

LINKS OUT

ASCOP: http://www.peakoil.net/

"The end of oil is closer than you think". In: The Guardian, 21 April 2005

EnergyBulletin.net

"It's the Oil, Stupid". In: Newsweek, 30 September 2002

Dry Dipstick

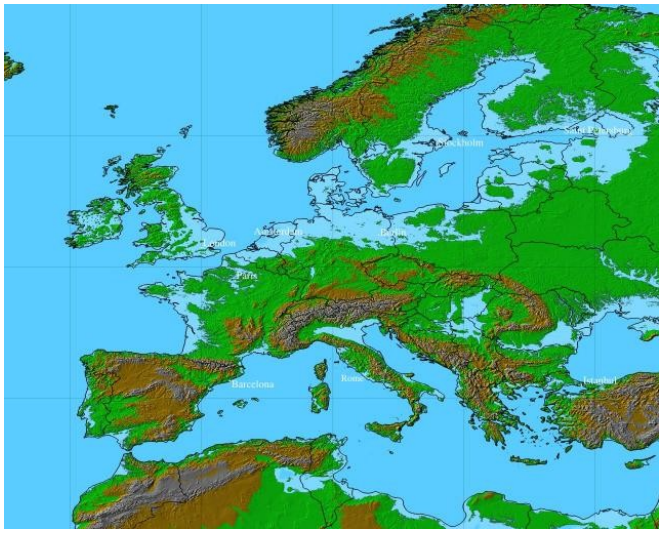
SEA LEVEL RISE – any day now

It won’t exactly rip apart our planet or terminate the Universe, but sea level rise may be the most real apocalyptic threat our world faces today. Better learn how to swim! For life in large parts of Europe, Asia and the US is about to become impossible.

Let’s do some time traveling. Let’s take a ride into the future. Several centuries ahead, that should do the trick. Now, look around.

You’re shocked by what you see, probably. The US east coast? It’s gone. Florida, Louisiana, the states surrounding the Mississippi? Vanished. In the Great Plains of North America, a vast ocean now stretches out.

In Europe, things aren’t any better. Northern France, England, Denmark, Northern Germany, Belgium and the Netherlands are all gone. Spain has almost become an island. Much of the former Soviet Union has turned into swamp. And how about The Baltic States, Egypt, Algeria, Vietnam and Bangladesh? All but vanished. Most of it is sea bottom now.



Europe at 100 m sea level rise. Paris has become a coastal city; Denmark, the Netherlands, England, the Baltic States and Northern Germany are swallowed by the waves.

Think of 80 meters sea level rise worldwide.Sounds wet, doesn’t it? Still, this is exactly where the sea level seems to be heading.

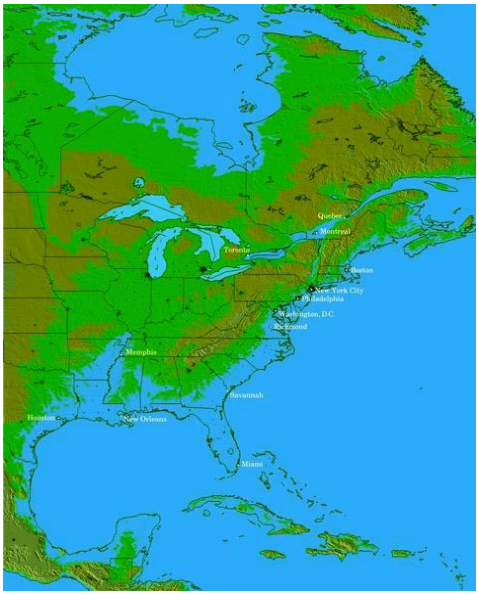
For now, we can relax a bit. The vast bodies of water needed to cause the Big Flood are still safely stored away, frozen in ice. You’ll find vast quantities of it on the South Pole, on mountain tops, and in the porous, permafrost soil of Greenland, Alaska and Siberia.

But as we speak, all of that is melting. The North Pole melts so fast it could be gone entirely by the year 2050. The Antarctic Western Tip releases ice much faster than it is replenished. In Greenland, Alaska and Siberia, the permafrost is melting, turning once-frozen soil into wetlands. Everywhere on Earth, glaciers are vanishing and mountain tops are blackening. And all of this water discharges into the sea.

The greenhouse effect is the most likely culprit. Every day, we pump vast amounts of carbon dioxide (CO_2) into the atmosphere, a gas that traps the warmth of sunlight. Consequently, it gets warmer on Earth. Because of this, the sea gets warmer, and expands.

But that’s not everything. The melting ice should be the next big problem on our hands. If Antarctic were to melt completely, it should give us 61 meters of sea level rise worldwide. Greenland should add another 7,2 meters; the glaciers 50 centimeters. That means: bye-bye Britons, farewell France, see you America - and all the rest.

Oh, you’ll just move elsewhere, or buy a boat, you say? Well, let’s face it. Right now, some 90 percent of all people live near the sea. Even one meter of sea level rise would destroy the US east coast and inundate places like the Maldives, the Netherlands, Bangladesh, the Nile Delta and Florida. Make that 80 meters, and virtually all of the world’s major cities drown. There won’t be enough land left for agriculture. And, ironically, there won’t be enough drinking water: most of it will have gone salt.



USA goes H2O: The US at 100m sea level rise.

And really, we’re up to our neck in this already -- literally. As the world heats up, all kind of evil feedback effects kick in. Take the North Pole. Ok, so it melts. Now that’s no big deal: it should not affect the sea level. But there’s a horrifying catch. The arctic ice also serves as a mirror, bouncing sunlight back into space. No ice, and the dark ocean will absorb the Sun’s heat, speeding up the warming of the oceans some more.

Or take Greenland. Should its permafrost melt, global sea levels will go up 7,2 meters worldwide. Now if you think that’s bad news, hear this. The permafrost holds billions of tons of frozen, organic waste, like a big freezer. No permafrost, and the dead stuff will rot. It’s gonna stink, and release vast clouds of methane gas. This should speed up the Big Melt some more, because methane happens to be a very powerful greenhouse gas itself.

So, where will it end? No one knows. One rather disturbing forecast is that the process only stops after the Earth has become a super hot, lifeless world, much like Venus. Outside, you’ll be able to melt glass and bake bricks. Life will no longer be possible on our planet.

Fortunately, it doesn’t have to end that way. Our planet has gone through stuff like this before. One hundred millions of years ago, back in the age of the dinosaurs, the Earth went Greenhouse too -- probably as a result of geological processes. Back then, our planet was almost completely free of ice. The sea stood actually 200 to 300 meters higher than today! But well, the dinosaurs didn’t mind.

And there’s another comfort. Luckily, the poles don’t melt overnight. The entire process should take hundreds, if not many thousands of years. There should be plenty of time to build some kind of Noah’s Ark.

On the other hand, it isn’t exactly reassuring that the Big Melt has started already. Of all the apocalypses you’ll find on this site, this is the one happening as we speak. Already, the sea level is 15 centimeters higher than it was 100 years ago. For the next century, it is expected to rise more -- anything between 10 centimeters and 6 meter, scientists argue. Might be a good idea to invest in life rafts!

The Antarctic 60-80 meters of global sea level rise	**Most of the Antarctic ice** is safe for now. It sits high and dry on the continent, where the warm sea water can’t reach it. But that doesn’t mean it will be there forever. There’s plenty of evidence the lower lying parts of Antarctica are getting unstable. On the Antarctic Peninsula, 87 percent of the glaciers are in retreat. In the west, about one third of the ice is getting thinner, at some places 3-4 meters per year. Should the western part of Antarctic melt, it would push up the sea level by 4 to 6 meters, flooding 2 billion people.
The Arctic no effect on sea level	**There’s overwhelming evidence** the Arctic is melting at an ever faster pace. Every ten years, its surface shrinks by 8 percent. Scientists expect that from about 2050 on, the north pole will be completely ice-free during the summers. Give that a thought: no more ice on the north pole!
Greenland 7,2 meters of global sea level rise	**Currently, Greenland loses** about 220 cubic kilometers of ice each year. That’s more than twice as much as ten years ago. And in March 2006, NASA satellites revealed dramatic melting of Greenland along the edges. Scientists believe that the

melting ice of Greenland has pushed up the sea level several millimeters already -- and that's just the beginning.

Mountain glaciers and caps
50 centimeters of global sea level rise

In 2003, the world was shocked to hear that a huge chunk of 'eternal' ice had broken off of iconic Mount Matterhorn. Well, it is just one of many incidents. All over the world, mountain ice is vanishing, leaving behind black rock and soil, and causing local disasters like floods, landslides and economic damage to winter resorts. Each year, the melting mountain glaciers push up the sea about 0,2 to 0,4 millimeters. And there is evidence they're melting ever faster.

The Austrian "Glacier" Pasterze, 1875 and 2004

Alaska

Alaska is among the regions hardest hit by global warming. Already, roads are collapsing, houses are cracking and entire villages are abandoned, as the permafrost they are build on thaws. Local authorities claim over 85 percent of all Alaskan villages have melt problems like mosquito plagues, eroding shorelines and tilting buildings. And that's just the start: researchers expect that the top 3 meters of permafrost will be gone by the year 2100.

Sinking building in Alaska

Canada

5-10 centimeters of global sea level rise

It has been estimated that Canada has lost 650 square kilometers of ice since the 1960s, pushing up the sea levels by 1,45 millimeters. In the meantime, Canada has the same melting problems as Alaska, Siberia and Scandinavia: it's turning into a muddy swamp.

Siberia

In 2005, researchers shocked the world, when they found that vast stretches of Siberian tundra that were supposed to be frozen had unexpectedly thawed. The big problem is not so much the melting itself -- but the extra CO2 it releases. Siberia's permafrost is one of the largest CO2-reservoirs on the planet. Thaw it, and you'll see a massive outgassing of greenhouse gases, boosting the warmi d

LINKS OUT:

BBC: Earth, Melting in the Heat?

Max Planck Institute: How Much Will The Sea Level Rise?

Astronomy & Earth Sciences: Could Waterworld Really Happen?

New York Times: Climate Data Hint At Irreversible Rise in Seas

Science Special Collection: Breaking the Ice

APPLET:

Flood Maps (this lovely applet simulates up to 14 m sea level rise)

DIMMING – any day now

You thought the Dark Ages are well behind us? Think again. As we speak, the world is getting darker. One day, we might even perish in a frozen, depressing shadow world. In fact, 'global dimming' may have killed hundreds of thousands of people already.

It’s some decades later. Things on Earth have gotten out of hand -- totally. Our planet has turned into a cold, terrible place. Outside, a dark gray ceiling of clouds permanently covers the sky. The Sun hasn’t shone for many, many years. It’s twilight out there, always. And it’s cold: a devastating ice age has come upon the planet.

Trust us: you **don't** want to live here. In the eternal night outside, people die by the millions. Those who survive, have turned into pale, sickly, depressed, lost souls who could do with a sunny vacation. In isolated bands, they stumble about through the darkness, cuddled together, clinging to life as good as they can. The stuff we call ‘culture’ has all but slipped away from them; the world's economy has long collapsed. Today, men live much like our ape-like ancestors did, always hungry, and always looking for food. They feed on a disgusting diet of slimy funguses, insects, rodents and mosses -- the only edible things that survive.

And frankly, without sunlight, mankind doesn’t stand a chance. Oxygen levels will drop, and food will get ever scarcer. In the end, we’ll die a horrible death, one man after the other, one community after the next. Probably, we will have forgotten what kind of a lush, sunny planet Earth once was.

- **Sun go out**: Without sunlight, no crops

Still, out there, above the clouds, the Sun is shining as bright as ever. It's the thick clouds, that are causing all the trouble. They bounce back the sunlight into space, preventing it from reaching the Earth's surface and its inhabitants. The result: darkness, and cold.

So, who put those clouds up there in the first place? Well, blame yourself: you did. You guessed it: it's those humans and their pollution again. The Dark Apocalypse even has an official name: 'global dimming'.

Already, the Earth is a bit darker and shadowyer than it should have been. Global Dimming was first discovered in the 1980s. In Israel, agricultural biologist Gerald Stanhill coincidentally discovered something weird: the sun shines about 22 percent less in Israel than it did in the 1950s. It is as if someone is slowly turning off the lights!

Then came 9-11. In the days following the terrorist attacks, air traffic was grounded. This led to a sudden, remarkable change in American weather. For three days, it was unusually sunny in the US. The nights were exceptionally bright. On average, it got one degree Celsius warmer in the US during those days. That doesn't sound like much -- but it's huge, in terms of climatology: the biggest jump in temperature ever witnessed.

After that, more evidence poured in that the world is really getting darker. Scientists discovered that water evaporates less readily than it did before. And the evidence came from all over the planet: the US is 10 percent darker now than it was in the 1950s, Western Europe 16 percent, and Russia almost 30 percent.

In fact, global dimming may have made its first victims already. In the 1980s, about a million Africans in the Sahel died during a massive drought. According to one theory, it was global dimming's doing: the Sun simply didn't shine hard enough to 'power up' the system that should have given the Sahel its rainy season. Poor Africans.

Freeze or fry?

But hey, wait a minute, wasn't the world getting warmer, instead of colder? How about global warming? You're absolutely right. There's massive evidence that the world is indeed getting warmer. But it's also getting darker. In fact, many scientists

believe that global dimming puts the brakes on the warming of our planet. Without global dimming, global warming would be much, much worse!

And there's no telling which will win in the end, heat or cold. Roughly speaking, global dimming is faster and heftier, while global warming is slower and more gradual. Somewhere down the line, there could be a threshold, a point where Dimming beats Warming. Suddenly, we'd see temperatures drop. We'd be preparing that rodent soup in the dark in no time -- say, within several generations.

On the other hand, maybe we will be fine. There's an upshot: the particles in the sky that bounce back the sunlight, don't live that long. They'll rain down on Earth and get washed away, and that will be it. No ice age, no chewing on rats and bugs. (Well, unless the so-called 'Hydroxyl Collapse' kicks in -- but that's another story.)

What's more, we're killing global dimming already. In Europe and the US, more and more laws forbid the use of fuels and chemicals that puff noxious particles in the air. Off with you, you mean, sunlight-blocking clouds of dirt!

But hold it. There could be a horrible backlash. Didn't we just say that global dimming very likely holds back global warming? There you go: if we stop polluting the skies and put that sunlight back on, the consequences could be truly apocalyptic. Global warming will fiercely kick in again. Suddenly, the Sun will shine abundantly, pushing temperatures up by several degrees. We'd have savage summers, and lukewarm winters.

According to several studies, this would sort of... well, kill us, really. By 2030, the poles, the glaciers and Greenland's ice sheet would melt. Sea levels would jump up, flooding billions of homes. The Amazon rainforest would whither and turn into desert. The northern parts of Europe and the US would get an African climate. We might even have a runaway greenhouse effect, a spine-chilling climate mishap that would literally kill every living on Earth.

So, what do you prefer? To fry or to freeze? Would you like to get roasted, or would you rather die in the dark, chewing on bugs? Hmm... Perhaps it's a better idea to cut down a little on both pollution and greenhouse gases, after all.

LINKS OUT:

BBC Horizon: Global Dimming

The Guardian: Goodbye Sunshine

Realclimate.org: What Is Global Dimming?

CLIMATE SHIFT – any day now

WARNING: We get a lot of mail from readers who got very scared after reading the scenario outlined below. Please bear in mind the events described here are still hypothetical. And if you scare easy - perhaps you should consider NOT reading this. - the editor

We're in for a surprise. A few tens of years more, and our climate might suddenly go totally berserk. For starters, it would turn our planet into a lifeless, super hot oven, much like the planet Venus. Welcome to the ghastly phenomenon dubbed 'the runaway greenhouse effect'. And the really scary part is: we might be heading straight towards it.

Phew! Aren't we lucky? In the 1990s, they predicted we would get climate warming. The poles were about to melt, they said. Entire countries would get flooded. Huge hurricanes would sweep across the globe. Millions would die. Well: they had it all wrong. It's the 21st century now -- and little has happened so far.

But then, suddenly, it all changes. From one month to the next, the climate of the world goes wild. Temperatures jump. The ice caps of the poles crumble, pushing the sea levels up. The snow caps on the mountain tops melt, turning even the tiniest rivulet into a roaring body of water. Cities are flooded, countries washed away. Tornadoes and hurricanes push across the globe. Harvests fail. Economies crumble. Tropical diseases like malaria and dengue push northwards. Forests turn into deserts. And of course, millions of people perish during all the mayhem.

And if you thought that was bad: you haven't seen nothing yet.Within a few decades, the situation goes totally out of hand. Temperatures just keep on rising, faster and faster. And as they do, more and more water on Earth begins

Wet Feet: When we think of global warming, we tend to think of floods. But that's only a minor inconvenience. Chances are the greenhouse effect "unleashes catastrophic and irreversible changes to key planetary processes", as the IPCC puts it.

to evaporate. The sea level begins to drop again. If you're one of those poor souls who had his country or city flooded when the ice caps melted, you might be glad to find the sea retreating. But don't put that flag out yet. What you're witnessing, is the end of the world. Nothing more, nothing less.

Here's how it goes. As the temperatures rise, more water evaporates. But as more water evaporates, our atmosphere gets thicker -- causing the temperatures to rise even more. And as the temperatures rise even more, even more water evaporates. And as even more water evaporates... You've got it: there's a chain reaction going on. The dreaded 'runaway greenhouse effect' has just kicked in.

Governments and scientists will desperately look for a way to turn the tide. But they won't find one. There's just no way you can stop something as mighty as the Earth's climate. Although our politicians might still mumble some reassuring words to prevent a general panic, deep within they will realize how bad the situation really is. A few years more, and our planet will no longer be habitable. All life is about to vanish from the planet formerly known as Earth. There is no escape, not even a remote possibility things will improve.

The best evidence for that is hovering in the night sky: the planet Venus. For many years, scientists wondered why Venus has an atmosphere so hot that lead and tin actually melt in it. Only in the late 1990s they realized that Venus too has undergone the runaway greenhouse effect. Its atmosphere is so dense, incoming solar heat cannot escape from it.

Exactly that, my friends, is what is happening on our planet. Earth is about to join Venus. We're about to literally fry to death.

By now, temperatures on Earth start getting really uncomfortable. Everywhere you look, there's this dense, watery fog -- it's water vapor, as you might have guessed. Where there used to be rivers, only dry gullies are left, carving through the barren landscape. And where the oceans used to be, only some lakes remain -- and they get smaller each day.

It's hard to tell how exactly humanity will die in the end. Perhaps we won't be able to stand the heat anymore, and literally find ourselves cooked to death by the ever increasing temperatures. Perhaps we'll suffocate, as our once fresh atmosphere turns into a dense brew of carbon dioxide, water vapor and methane. Perhaps we'll survive all that, clinging to our

Bad Omen: The planet Venus has an atmosphere over 90 times thicker than Earth's. And it's bloody hot out there: about 750 degrees Celsius. Still, exactly the same could happen to our own planet if the Runaway Greenhouse Effect kicks in.

gas masks and our airconditioning -- and in the end starve to death because all plants and animals are gone.

One thing is absolutely certain, though: it will be some gruesome, hellish end. After a few years or decades, our planet has become a deserted fog planet, with an atmosphere so hot that lead and tin actually melt in it. Life will be no longer possible -- except perhaps for a handful of soil bacteria that are able to withstand all the nastiness.

The Runaway Greenhouse: The facts

Of course, we could have known what was coming. Ever since the 1990s, there were some climatologists warning for it. But their calculations were laughed away, ill understood by the general public or ignored by the politicians in charge of things. The climatologists were dubbed pessimists. Even though their computer models told otherwise.

As late as 2001, the UN's Intergovernmental Panel on Climate Change (IPCC) formally warned that the greenhouse effect could 'unleash catastrophic and irreversible changes to key planetary processes that make the world habitable.' In 2005, a British government research council repeated the warning. And added the effect could kick in as soon as 2015.

The runaway greenhouse effect works quite simple, really. First, you should realize why we have an atmosphere in the first place. That's because there's a lot of water vapor and carbon dioxide in the air. There's nothing wrong with that. The carbon dioxide and the water vapor serve as a 'blanket': they prevent some of the incoming heat from the sun from flying off again into space.

Killer Fog: The atmosphere will turn the planet into a shadowy fog world, as the atmosphere fills itself with water vapor.

At least, that's how things went until one day, six billion humans came around. Mankind literally pumps trillions of tons of greenhouse gases like carbon dioxide and methane into the atmosphere.

No big deal, so far. Calculations show that this massive amount of extra greenhouse gas will only push up the Earth's temperatures a few degrees. Besides, about one quarter of all the methane and the carbon dioxide is cleaned up by nature each year.

But around 2015, that could suddenly

change. The climate warming could pass a critical threshold. The ice caps of the poles could melt. This would set free billions of tons of extra carbon dioxide: the ice caps are full of tiny bubbles of trapped ancient air with a lot of carbon dioxide in them. This suddenly gives an extra push to the greenhouse effect.

Also, the warming could unleash carbon dioxide that is trapped in sea sediments, in the permafrost of Greenland and in the soil. And worse: the warming could set free the trillions of tons of methane that are stashed away below the ocean's floor and in the permafrost. At the same time, nature could get ‘saturated’ with carbon. Of course, plants and soil organisms will still breathe carbon dioxide. But there will be too much of it.

And in the end, the water vapor kicks in. While it gets hotter, oceans and rivers start to evaporate. This would make the atmosphere denser and hotter, pushing up the evaporation, making it hotter... And so on.

Then you would have it: an environmentalists nightmare. The greenhouse effect will go wild. And wilder still -- until we live on a planet with an atmosphere so hot that lead and tin actually... You can fill in those words yourself by now, right?

So: abandon all hope?

To be honest, of all end of world scenarios outlined on this site, we at Exit Mundi find the one with the runaway greenhouse effect particularly scary. Of course, there’s the problem withmeteors, and the risk of robots taking over. But the greenhouse effect is happening today, as we speak. It seems to be only a matter of time before we can begin to melt that lead and tin.

On the other hand: climate is a difficult beast. If we’ve learned one thing over the past few decades, it is that no one can really predict how the climate will change on us. For example: there’s a good chance the greenhouse effect unleashes not a runaway chain reaction -- but an ice age, as reportedelsewhere on this site.

Also, Earth survived intense heat before. 50 Million years ago, the North Pole had no ice, but a subtropical climate. And before that, in the era of the dinosaurs, CO2-levels were about four to six times higher than today. Back then, sea temperature was up to 40 degrees Celsius, and many continents were flooded. It was really a greenhouse world - and it didn't went out of hand.

On the other hand, even if there's a remote possibility it DOES go out of hand, there’s plenty of need to worry. We don’t know about you, but we at Exit Mundi prefer neither the ice age, nor the super hot Venus-like atmosphere. We like things the way they are.

So if you read this and you happen to be one of those top dogs in charge of things: hey, it’s only one atmosphere we have here, PLEASE be a little careful with it!

POLLUTION – any day now

If you think you’ve seen pollution -- just wait. One day, we could suffocate in a killer smog never before witnessed on Earth. There are some pretty nasty clues that the clean-up system of the atmosphere is on the verge of collapsing. And when that happens, better go build yourself a glass dome to live under!

It is eco-disaster at its very worst -- a cruel apocalypse that could kill billions of people, and change the face of the Earth forever. One day, everything seems quite fine. But then, all hell breaks loose.

Suddenly, the pollution from our factories and cars just won't go away anymore. It is as if the cleaning firm of the planet has decided to quit. Polluting chemicals don’t rain down anymore, and seem to refuse to dissolve in the oceans. They just hang around, forming dense, thick mists of dirt. Of course, we’re having our share of smog already. But it doesn’t compare to the Mother of all Smogs that is being unleashed now.

The consequences are dramatic. Within years, huge parts of the atmosphere become a foul reeking, toxic brew of exhaust gases, soot and factory filth. Asthma and lung diseases become the world’s biggest killers, smog one of its worst problems. Big cities like Tokyo, Athens and New York are permanently covered in dense death fogs. Wearing a mouth cap or a gas mask outdoors becomes common as wearing shoes. But still, people die by the millions.

And it goes beyond that. The wind pushes the toxic clouds around from one place to another, bringing death and destruction to the countryside. Animals become sickly, crops turn brown and whither. Forests die on a vast scale, and huge forest fires consume the remains. The weather forecasts will

highlight what pollution goes where, instead of silly nonsense like whether we will have rain or sunshine tomorrow.

In the meantime, hundreds of millions of eco-refugees will try to escape, causing uproars, wars and famines. In the rich countries, people will build huge domes over their cities, with purified air in it. But in the poorer countries, the smog disaster strikes all the harder.

The hydroxyl apocalypse

What you're witnessing is a phenomenon known among scientists as the ‘hydroxyl collapse’, or, more technically, the breakdown of the 'oxidizing capacity' of the atmosphere. Don’t worry if that doesn’t ring a bell -- it’s a rather obscure thing. Scientists worry about the ozone layer, greenhouse gases and stuff like CFCs and CFKs -- not hydroxyl.

That’s partly because hydroxyl is a benign little substance. You could call it the detergent of the atmosphere. The stuff (formula: OH-) attacks smoke from our factories, cars and chimneys, and makes it soluble in water. After hydroxyl’s touch, pollution can rain down and vanish in the soil, or dissolve in the ocean.

But no hydroxyl, and we’re in trouble. Evil noxious gases like sulphuric and nitrogen oxides would pile up. No hydroxyl, and smoke and soot would accumulate in the atmosphere.

And ‘no hydroxyl’ could be where we’re heading. In the 1980s, NASA scientists came up with figures that suggested the amount of hydroxyl in the air has dropped by 25 percent since 1950. And in 2001, the UN’s Intergovernmental Panel on Climate Change (IPCC) predicted a 20 percent drop of hydroxyl activity in the century to come.

Then, in 1993, Sasha Madronich, a researcher working for the US government, made a frightening discovery. At some point, Madronich calculated, pollution will overwhelm the hydroxyl chemistry. There will be so much filth around, the detergent will simply give up -- and quit. In fact, over some polluted areas, the hydroxyl shutdown is happening already, Madronich points out.

So... What is this hydroxyl stuff, anyway?

Hydroxyl (OH-) is a fleeting, highly reactive substance that pops in and out of existence everywhere around us. Roughly, a hydroxyl 'radical' is around only for a second at most, because it reacts so readily with other compounds. Hydroxyl shows up when you bombard water vapor with ultraviolet radiation.

There’s only a tiny fraction of hydroxyl in the air. Scoop up a chunk of air as big as the Mount Everest, and you will find hardly enough hydroxyl to fill a bucket!

Still, it’s effective stuff. It ‘oxidizes’ gases like carbon monoxide (CO), carbon dioxide (CO2), nitrogen oxides (NOx), sulphuric dioxide (SO2) and methane (CH4). This means that the gases get prepared so that they chemically bind to water -- and that they can rain down and end up in the soil or in the ocean.

Okay, so we'd just cut down the pollution, right? Unfortunately, that won't help. The calculations show that once the hydroxyl collapse has kicked in, there is no turning back. A chain reaction will set in, emptying the atmosphere of hydroxyl. Shutting down a few factories won't bring the clean-up system back on.

There's a weird twist, too. Hydroxyl is formed under the influence of ultraviolet radiation from the Sun -- the sort of radiation that causes skin cancer. So it may be actually a bad thing that the hole in the ozone layer is currently closing up again. The ozone layer protects us from ultraviolet radiation. But it also puts a break on hydroxyl formation.

Now that's some funny paradox. We might end up sitting under a glass bell -- thanks to the fact that the ozone layer is in tip-top condition again!

Aw, these climate issues... Why are they always so terribly complicated?

LINKS OUT:

The oxidizing capacity of the atmosphere

Pollution scenario

TERRORISM – any day now

And then, there are those who frantically try to bring about the end of times themselves. To fulfill the Apocalypse out of some religious scripture, or simply, to get attention. But could a terrorist actually do it? Probably not. However, an enterprising terrorist could always try out one of the following ideas, bringing about a disaster of truly apocalyptic proportions.

1. Paint a pole
Difficulty: Hard
Needed: A big amount of dirt

Find a way to blacken the ice of one of the poles (the South pole is best). Cover it with dirt, soot or charcoal. Tainting it black with ordinary paint might take a little

longer. A black pole doesn’t reflect sunlight but absorbs warmth -- and melts. The result: climate change, sea level rise, inundations and much annoyment for your enemies.

2. Design a disease
Difficulty: Very hard
Needed: A well-equipped laboratory, biology training

Build a biotech lab in some obscure country and hire some bad guy scientists who share your evil ideas. Now, piece together a version of Ebola that spreads through air. Design a new, upgraded version of the flu, or AIDS. Alter the camel pox virus so that it infects humans. You’ll find all the basics you need to know in the scientific journals and textbooks.

Now comes the tough part. The best way to spread your disease, is to infect yourself and visit the public transportation facilities of the cities you wish to attack. Cough, sneeze and snort at will. Touch every handle and doorknob you encounter with your virus-laden hands. You will see: it’s gonna be fun.

An even more evil way to spread your doomsday disease around, is by letting animals do it for you. This takes a little extra research. Find out what animals carry your germ, preferably animals that don't go ill themselves. Most diseases have such a ‘carrier animal’: SARS, for example, gets carried around from human to human by common house cats.

A carrier animal will make your virus all the more successful, because it will be very hard to detect and even harder to contain the outbreak. Another upshot is that you survive the attack yourself. You might want to stick around to witness the misery you’re causing.

3. Detonate a disaster
Difficulty: Medium
Needed: An atomic bomb

Give a terrorist an atomic bomb or a huge amount of explosives, and he will immediately run off to blow up Washington DC. Dumb, of course. There might be better targets.

- A well-chosen spot on the Western Arctic ice sheet might accelerate the melting of the pole. This should give you four to six meters of worldwide sea level rise, inundating many vital areas in Europe and the US.
- A big enough boom in Yellowstone Park might awaken the now dormant supervolcano under the park, turning half of the US into an ash-covered no man’ s land and bringing ice age to Europe.
- Blowing up the already unstable volcanic island of La Palma could prompt a mega-tsunami, which would slosh cities like New York City, Boston and Miami to

kingdom come.
- A massive explosion on the seabed in the Gulf of Mexico could trigger a vast methane gas eruption, warming up the world’s climate and -- with some luck -- causing a huge firestorm over the US.

And the really good part is: you will find no guards on ocean floors, pole caps and volcanic islands.

4. Smash the dollar
Difficulty: Medium
Needed: A large amount of money, a PhD in economy

Forget the Twin Towers, attack the US dollar instead. Become a stock broker, and infiltrate the stock markets. Now, organize a coordinated attack, Al Qaeda-style, on the US dollar. With some luck, you'll see the dollar die before the day is over, bankrupting the US and leaving it in economic shambles.

Know: every second, the US loans 18,000 dollars from abroad. The US national debt has passed the eight trillion dollar mark already. That's 8,000,000,000,000 dollar! The reason is that US citizens and the US government spend more money than they make. So, they're living on borrowed stuff.

This leaves the US dollar very, very vulnerable. One good punch, and the buck might fall over. So, sell a vast amount of dollars, preferably in a coordinated attack from multiple places. This should cause the dollar to take an evil plunge. Other stock brokers and banks should respond and sell their dollars, too. The dollar will plummet even further. Within days or even hours, dollar notes will have become worthless scraps of paper. Americans abroad will find they can no longer pay their bills. Oil producing countries will switch their currency from the dollar to the yen or the euro. Trade will grind to a halt. There may be riots, or wars, or both. You'll have fun!

In the end, the US will be alone in the world, a poor and bankrupt country with high unemployment, no fossil fuels and in need of almost everything. Things will never be the way they were. The yen or the euro will have replaced the dollar as the world's main currency - just like the dollar dethroned the English pound in the 1920s.

5. Crush a current
Difficulty: Hard
Needed: Several ships, plenty of salt

It’s a bit of a long shot, but with some luck you may be able to plunge the Western world into an ice age. Now, wouldn’t you just love that?

The only thing you need to do, is disrupting the North Atlantic Current. This ocean current brings warmth from the tropics to Europe and the US. Without it,

temperatures would be up to 10 degrees lower, disrupting agriculture and wreaking havoc with the economy of the civilized world. They would hate your guts for it, those westerners.

Already, the North Atlantic Current is weakening. And the best part is: some scientists believe that the current could break down relatively easy. Perhaps you may be able to kill the current yourself!

So, warm up the sea water near Greenland with atomic bombs. Load some ships with salt and sink them in the Atlantic. This should make the sea water locally denser and heavier, putting a 'plug' on the current. Blowing up some well-chosen glaciers on or near the South Pole might do the trick, too.

We warn you: it is all very speculative. But failed crops, severe winters and millions of pissed-off westerners could be your reward.

6. Bring in the plagues
Difficulty: Easy
Needed: A library membership, plane tickets

If you’re a terrorist with a small budget, you could always try to unleash an agricultural plague of apocalyptic proportions.

Already, there are many pests around, causing billions of dollars of damage. Locusts, rabbits, parasites, fungi, worms and insects often become a plague when they’re introduced to a place where they're not supposed to be. The critters encounter no natural enemies, multiply wildly, and become a plague. That’s why Australia and New-Zealand have their rabbit problem and the US has its boll weavil.

So, study agricultural diseases. Track down some obscure Asian fungus or insect, and bring it over. Smuggle some sinister bird disease to the country you like to attack, and introduce it to its chicken farms. Bring in foot-and-mouth disease, or mad cow disease. Introduce weird weeds, exotic moths, sex-crazy rodents, hungry beetles and obscure insects. It might take a while before your Apocalypse kicks in. But boy, will it be some mess.

7. Shortcut a state
Difficulty: Hard
Needed: Explosives, wire, a high-altitude airplane

Can't afford an atomic bomb? Don't panic. There's always 'the poor man's atomic bomb'. That's a device called an 'electromagnetic pulse weapon', or simply e-bomb.

E-bombs are quite easy to make. Just take a big 'sausage' of explosives, wrap coil around it, and put a magnetic field to the coil. Should you decide to detonate your e-bomb high up in the atmosphere, you should shortcut every piece of electric equipment below you. The bigger the bomb, the bigger the damage. It'll be fun.

NANOTECH – AD 2010

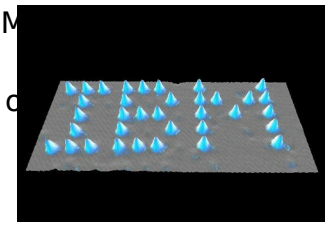
Oops, that's gotta hurt! It's almost too absurd to consider, but in the near future it may be a very real possibility: all life on earth is eaten up by man made machines, in what physicists euphemistically call `the gray goo problem'.

It was no one less than the Nobel prize winning physicist Richard Feynman who gave rise to the `problem'. In a famous 1959 lecture, Feynman predicted that man will some day be able to make **nano machines**, devices so tiny that you can't even see them. A nanometer is a billionth of a meter, and a nano machine would be a thousand times smaller than the thickness of a human hair.

Well, mr. Feynman wasn't drunk when he predicted this. Machines ARE getting smaller: just compare the microchips of today with the huge taperecorder-like computers from the fifties. But it can go much smaller still. In principle, Feynman foretold, you can make computers and other gadgets out of single atoms. You only have to `click' them together in the right way, like tiny pieces of construction lego.

And he was right. In 1986, the physicist K. Eric Drexler took up Feynman's ideas, and coined the term **nanotechnology**: `the technology of creating and working with devices only a few nanometers big', as it is defined. In 1990, the world realised that this was no longer science fiction, as a team of IBM researchers managed to arrange 35 single xenon atoms so that they spelled out the logo of IBM. Rumour has it that another research team responded to this crafty display of atom knitting by doing some intellectual nano graffiti: `Bill Gates sucks', also jotted down in single xenon atoms.

Nano M
logo
spelled o



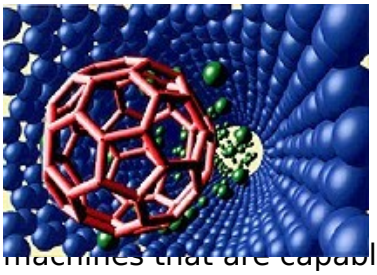
Ever since then, nanotechnology has underwent a modest revolution. With the coming of the **Atomic**

Force Microscope, which uses a tiny `needle' to explore the surface of materials, scientists have been able to `pick up' single atoms and move them elsewhere. Numerous universities and privately funded institutes engage in nanotech. Nano engineers have at their disposal a toolkit full of crafty gadgets, ranging from nano trains that transport atoms across a nano track, to a nano pen that squirts out atoms instead of ink. Also, there's a growing collection of nano switches, nano wires, nano tubes and - more recently - the first nano `engines': rotor shaped molecules that rotate under the influence of the right changes in temperature and light.

Well, but we're still alive and kicking. So where's the gray goo? O, wait and see. The end of the world may be nearer than you think.

Nano philosophers foresee that one day (some estimate around 2010) it will be possible to create a **nano assembler**: a man made molecule, that is `programmed' to create certain things out of raw materials. A nano assembler would for instance pick up plain carbon atoms and rearrange them into the molecular structure of a diamond. Or it would make water out of the atomic parts of plain air. Or a cheese sandwich out of dust. Or water into wine, you name it.

This notion is not as weird as it sounds. Our DNA- and RNA-molecules do it all the time! They pick up the raw materials from our food, and turn them into complex molecules. DNA and RNA are nano assemblers that manufacture whole organisms, with arms and legs, and fingers that can type the word `nanotechnology'.



So, if a nano factory can be programmed to create a cheese sandwich out of atoms, why wouldn't it be able to create new nano factories? This in fact is exactly the way it will be, at least according to nanopioneers like K. Eric Drexler. Let's face it: it's a hell of a job to build a nano machine by hand. It would be much easier to make nano machines that are capable of copying themselves, much in the way DNA-molecules replicate themselves. Nano scientists claim it is even essential for a nano machine to be self-replicating. Since they are so tiny, we would need millions of them to be of any use. It would take a lifetime to make them all by hand. Nano factories are thus by definition **Von Neumann machines**: devices capable of creating new copies of themselves.

But there's a nasty downside. What will such a self-replicating nano machine do if you carelessly tossed it away? You guessed it: it would go on grabbing all atoms within reach, rearranging them into copies of itself. And the copies would make more copies of themselves. And those copies would make even more copies of the copies of the copies. And so on.

No, you just DON'T want to know what this means. Within only 72 hours after the release of the first molecular nano machine, every single atom on earth would be

`used' to create new nano machines. In other words, all plants, animals, humans, cars, buildings and even rocks would have been `eaten up' by a vast, exponentially growing army of invisibly small nano devices.

There you have it: gray goo. Lots of it. Bye-bye world.

BIOTECH – AD 2010

It’s about the weirdest apocalypse you could think of. One day, our planet may become completely overgrown with… food. And the problem is: it could happen a lot sooner than you held possible.

It will be some end. Suddenly, there will be grain everywhere. Grain in the countryside. Grain on the beaches. Grain shooting up along every road. In your backyard: grain. Popping up from the cracks in sidewalks: more grain. Everywhere you look and everywhere you go – grain, grain, grain. Now if that isn’t a green revolution, what is?

Of course, there’ll be plenty to eat. But there’s a drawback: bread will also be the **only** thing around. The grain will overrun all other crops. Agriculture will be disrupted. Forests and grasslands will be demolished. Slowly, the entire food chain breaks down, as the face of the planet turns into an endless field of waving grain.

Governments will speak of the `Grain Problem’ and cook up plans to push the grain back. But the grain won’t listen. Suddenly, mankind finds itself in trouble. Diseases emerge, people go blind or develop brittle bones -- all because of the one-sidedness of their diet.

And then there are the side-effects.Every now and then, suffocating grain dust tempests sweep over the planet. Incredible grain field fires occasionally burn down a country or

two. Entire continents dry up, as the grain sips up all the water. The atmosphere, having to deal with the grain dust, the smoke from the grain fires and the lack of water, will get messed up. There may be an Ice Age, or even a kind of Nuclear Winter. It isn't very hard to see what it all boils down to. Humanity is thrown back into the Stone Age – well, `Grain Age' is a more accurate word. So next time you have a slice of bread, just remember: one day, bread could do us all in.

Sounds far-fetched? Sorry, but it isn't – not at all. The grain we're dealing with here isn't just the next species of grain. We're talking **Super Grain** here; grain that is genetically modified. Already, there are hundreds of genetically modified (GM) crops around. The idea is quite simple. Genes define the properties of everything that grows and lives. So in genetic engineering, what you basically do, is take a crop, add a gene here, take out a gene there – and there you have it: a new species of grain, with some handy new properties.

Genetic engineering is quite cool, really. You can make Super Maize that's resistant to certain diseases, so you don't have to spray all those polluting pesticides over them. You can create a new brand of Super Rice that's nutritious enough to feed even the poorest country. Heck, you can even piece together a Super Apple that protects your teeth from rotting. Or a Super Potato that survives frost. A Super Tomato that grows in salt water. If you think that sounds too weird to be true, don't look now: all these crops already exist today!

Of course, governments and genetic companies are cautious. You just DON'T want your new breed of Super Crop to accidentally mix up with the common stuff. Genes pass from one generation to the next. So if you mix up genetically modified crops with common crops, in no time you'll only have the GM species left – GM crops having a huge evolutionary advantage over the ordinary stuff.

Still, this `leaking' of GM crops into normal nature is exactly what is happening as we speak. In China, where there's little government control over GM farming, the so-called Golden Rice is rapidly replacing common rice. At the moment we write this (March 2002), 5,5 million farmers worldwide grow GM crops. In only four years time, the amount of farmland occupied by GM crops has doubled, from 25 million hectares of farmland in 1998 to more than 50 million hectares in 2002. That's an area the size of Italy!

Corn killers: Experimental GM crop fields are regularly demolished by protesters. But there's a catch: on at least two occasions, the protestors helped the GM plants escape into nature, accidentally taking the seeds with them on their clothes and shoes.

Meanwhile, in the West, every now and then an accident happens. In Canada, genetically altered oilseed rape `escaped' from the test

fields into the countryside. Right now, Super Oilseed Rape is shooting up everywhere in Canada. And in Mexico, genetically altered Super Maize suddenly showed up in November 2001. This really baffled everyone – Mexico has banned all GM farming years ago!

So, it only seems reasonable to conclude that one day, most crops on the planet will be genetically tinkered with in one way or the other. OK, so what, you may ask. As long as it tastes good, there's no need to worry, right?

Well – there are these disturbing risks. One day soon, we may create a true Super Crop that is utterly resistant to disease and pollution, and is able to grow in literally every environment. A crop like that might take over the countryside in no time – and start haunting us. Your beloved new crop will turn out a pain in the ass, an ineradicable Super Weed. No deterrent will kill it, no climate will stop it. There you have it: the Grain Problem. And of course, we said `grain' only for arguments sake. It could be soy, or maize, or rice. Or raspberries, tomatoes, cucumber or lychees -- whatever you can think of.

Oh, and of course it would be rather inconvenient if of all crops the Super Crop that conquers the world turns out to be... cotton. What would we have to eat? Cotton cookies, perhaps?

And wait: what about `Contraceptive Corn'? In early 2002, the San Diego-based biotech company Epicyte developed a new breed of GM corn that can be used as a contraceptive. The corn kills the sperm cells of men that eat it, rendering them infertile. Well, you just DON'T want a crop like that to conquer the world. Humanity would be, er... fucked. Within one or two generations, our species would no longer be there.

Paris, 2050?

And then there's the remote but rather unpleasant possibility that a GM crop suddenly brings forth some kind of new killer virus or bacterium. No, really! Toying around with a plant's genes may accidentally `awaken' an inactive, old virus that lays buried deep within the plant's DNA. Just picture that: cheerfully, you go out to harvest your brand new GM crop, but when you get back, your skin has suddenly turned blue with pink dots, due to some incredibly weird and exotic new disease.

Just imagine what a bummer that would be. Finally, we've created a crop that is so totally perfect that you can grow it anywhere you like. Well – except you can't eat it, it's growing all over the place, and it makes you ill or infertile. It would be the biggest joke in history. And, probably, the last.

NUCLEAR WAR – any day now

Lucky you. You survived a nuclear war! Well, don't be too glad. What happens after it is so gruesome, you'll wish you had died on the spot.

Today, it all goes out of hand. The East-West conflict revived. China waged war on Japan. The Muslim nations joined forces against the USA. Or someone simply made a mistake -- whatever, it doesn't really matter. The only thing that does matter right now is that the inconceivable has happened. There's nuclear war. And now, the SBM's, ICBM's and SLBM's cross the sky, like oddly shaped, featherless birds of destruction.

All hell breaks loose. There's eye-popping flashes of light everywhere and ear-ripping bangs as the bombs go off. Cities evaporate. Infrastructures crumble. Everywhere, huge mushroom-shaped clouds tower up into the sky. All electricity goes out because of electro-magnetic effects. And of course, many die: according to even the mildest scenario's, hundreds of millions die instantaneously as the nukes go boom.

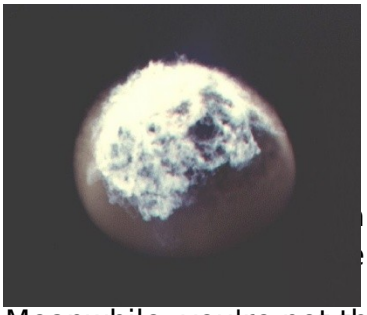
But you -- you survive all that. Better take shelter: for the next days, it will rain highly radioactive fall-out particles only. For almost three days and three nights in a row, it will rain radioactivity in a region several hundreds of kilometers around each impact site. And to be honest: it's best you stayed indoors for a whole year, patiently waiting until radioactivity levels finally begin to drop.

But wait, there's more trouble. As the mushroom clouds begin to fade, the REAL consequences of nuclear war become apparent. From the explosion sites, huge amounts of evaporated stuff, smoke and soot rise up into the sky. It's quite different from the usual smoke columns that come from fires. The intense heat from the nuclear impact sites pushes the debris straight into the highest parts of the atmosphere, the so-called**stratosphere**. There, it slowly starts to disperse, covering ever bigger portions of the world. But what's worse -- the soot blocks the Sun.

Within days, a weird and unprecedented climate shift sets in. Total darkness covers everything. Temperatures drop rapidly. And chances are the soot blanket that prevents the Sun from shining spreads across the globe, transforming even the

Latin Americas, Asia and Africa into chilly shadow worlds. There you have it: the infamous, dreaded **Nuclear Winter**.

Within weeks, it's minus 23 to 30 degrees Celsius everywhere. Do you live near the shore? Consider yourself lucky: since oceans cool so slowly, temperatures near the sea will drop `only' some five to ten degrees. But there is a downside: because of the big temperature differences between the sea and the inland, unimaginable storms and hurricanes will harass the coastal areas.



Oh, and that's just the beginning of your Winter out of Hell. Slowly, particle-by-particle, the soot will begin to fall back to the Earth. The results are not what you call pleasant. When it rains, the rain consists of burning sulphuric acid. And when it doesn't rain, the wind blows rticles of radioactive dust into your face. There's not re to kill you. But it won't do you much good either.

Meanwhile, you're not the only one having a hard time. Plants, living on sunlight and warmth, will die within weeks. Animals, relying on both plants and warmth, die too. Other animals perish because all water is frozen. After a couple of months, there won't be any birds anymore. And what's worse, the animals with the biggest chance to survive are not exactly what you call good company in the pitch-black darkness: insects, rats, flies and cockroaches. They have a great time, having all those dead bodies to feast on and no birds to hunt them down.

Oh, and talking of dead bodies: there will be outbreaks of all kinds of diseases. The radioactivity will speed up the mutation rate of viruses and bacteria tremendously. There will be outbreaks of all kinds of diseases, while it is more than likely all kinds of new diseases will pop up too. By the way, the radioactivity boosts the mutation rate of your own DNA as well -- which in effect means you'll develop all kinds of cancers and give birth to gruesomely malformed babies.

By now, you may start to wish those mean, black clouds that block the sun would bugger off. And eventually, they will. Depending on how many bombs exploded during the nuclear war, it will roughly take several months to a year before the sky starts clearing up again. But when it does, the end of all endurance is still not in sight.

One particularly nasty problem is that the soot from the impact sites has wiped out most of the ozone layer by chemical reactions. And without the ozone layer, we're exposed to the malignant ultraviolet radiation from the Sun. The UV-radiation kills the plants that may still be there, and causes more cancers and even sores and burns among humans. For years and years to come, you'll have to take shelter when the Sun shines.

And for the long term? The prospects are grim. With society disrupted, the food chain torn apart and humanity diminished, we'll be lucky if we're `only' thrown back into the Stone Age. A lot of species will become extinct. We may very well be one of them.

But wait a minute. Nuclear war, is that still possible? The answer is a plain and clear `yes'. Sure, the Russians and the West more or less like each other now. But the world is still armed to the bone with some 50,000 nuclear warheads. Although there's no finger on the trigger right now, the trigger is still within reach -- and the gun is fully loaded. And of course it doesn't really help more and more countries got nukes. India and Pakistan have at their disposal about a hundred nukes; thousands of nuclear weapons are spread over the many unstable countries that once made up the Soviet Union.

There's one reassurance, however. In principle, since its discovery in the 1980s, everybody knows what a Nuclear Winter is. You'd expect the world leaders to keep that in mind. The biggest nuclear weapons threat facing us right now is a small-scale nuclear war -- or a nuclear bomb attack by terrorists. But although that's awful enough, a small-scale nuclear war isn't enough to trigger a full-scale Nuclear Winter.

But then again, as history demonstrates, things can get out of hand really fast. One moment there's peace, and the next moment, there's war. So better go find those good old `Ban the bomb'-buttons of yours again!

EMPS

So, what if our machines suddenly broke down? Not just your TV set or your car -- but everything? It wouldn’t exactly kill us on the spot, but we can agree on one thing: it would be pretty apocalyptic. Weirdest of all, the Machine Apocalypse could happen for real.

Surprise, surprise. Suddenly, you see a sharp, blue flash shooting across the sky. And the next moment -- everything is dead.

Well, not everything. You are still alive and doing fine, and so are all other people, as well as all animals and plants. But your machines, they’re all dead. Dead as a doornail.

If you’re by car, train, subway, ship or airplane -- it grinds to a halt (which is of course rather inconvenient if you happen to be sitting in that airplane). If you’re listening music, it stops. If you’re gaming: game over. Computer screens go black, lights pop out, factories stop. An eerie silence falls upon the civilized world.

And it’s permanent. Tele erie glow, then go dark forev the inside. MP3-players and power stations give off a founta lon’t want to be wearing a pac

Now isn' Suddenly, you’re stumbli e, is on foot. Basic stuff like cloc never work again. Pretty soon, run out, and the shops will be em ck into the Middle Ages. And no man. Better use a homing-pigeon, from now on.

What you’ve witnessed is what’s known as an ‘electromagnetic pulse’, or EMP. Perhaps some wicked genius detonated an EMP-weapon high up in the atmosphere. Or perhaps some star violently exploded nearby.

Whatever the cause, the effect is the same: the atmosphere is flooded with exceptionally highly charged light particles, called photons. The photons smash into the atoms that make up the atmosphere, and knock out their electrons. That’s the flash of light you see: suddenly, a HUGE cloud of electrons comes surging down, much like a ridiculously large bolt of lightning. The electrons demolish everything electric. Everything with circuitry or wiring in it, turns into a foul-reeking porridge of molten plastic and short-circuited wires.

Indeed, EMP’s can be that nasty. The calculations show that a large enough EMP going off high in the atmosphere should be able to knock out every machine in Europe

Poor Man's Doomsday Weapon? - There is some concern terrorists may disrupt the West, using a very large electromagnetic pulse bomb. Indeed, EMP weapons are cheap to make. But don't get paranoid: you'd have to be one goofy whiz kid terrorist to achieve it. Oh, and what they don't tell you, is that the only country that has used e-bombs in combat already, is the US. During the war in Iraq, the US Army dropped several small e-bombs on power stations and television stations. That worked.

or the US. If a large stellar explosion flooded the atmosphere with super-charged photons, it could even get worse. The dreaded machine-killer may even affect half of the globe -- and all of mankind.

It’s difficult to tell what will happen next. With luck, some machines will survive. Devices running on batteries or machines that were turned off during the blast, have a far better chance of survival.

And of course, diesel engines and steam-powered machines won't be affected -- although you may be unable to operate them, without the electrical circuitry that’s usually needed to run them. For transport, you may want to use a horse or a bicycle (with no light). And you may be relieved to find that your hammer, screwdriver and other basic working tools are still in tip-top condition. At least, you can try to build up society again by hand.

So in the end, we should survive -- but not without a terrible crisis. Just read how one of our readers cozily puts it:

"We will have no food. We will have no clothing. We will have no access to the information needed to make that food and that clothing. The ending will be sudden and complete. If air systems are needed, the deaths will come in minutes. If water is needed, deaths will come in agonizing days. If food is needed, death will pay a visit only after several excruciating weeks. People escaping the clutches of the Machine will not be able to cope with an environment that doesn't pamper them anymore. They will die clutching the remotes that used to make the Machine do what they wanted and needed. They will die hungry, thirsty, filthy and cold."

Bomb or bug?

We don't really know how big the danger is. We've only had electric wiring for a mere 150 years - a tiny fraction of the planet's history. No one knows how many times the Earth has been hit by immense EMP's from outer space already.

And come to think of it, it gets worse. A large EMP isn’t the only thing that is capable of shutting down our machines. Perhaps, a simple technical failure can do the trick, too. That’s less silly than it sounds. We live in an ever more connected world, with ever more connected machines. This makes us vulnerable to power failures, computer bugs, system malfunctions -- stuff like that.

Take the infamous Northeast Blackout of 2003. No less than 50 million

- **Walk of Shame**: Without machines, we would find ourselves in the Middle Ages. For instance, we'd have to walk -- just like these New Yorkers during the 2003 blackout.

people in the US and Canada found themselves without electricity. And the cause? For crying out loud, it was a humble tree that gently touched some power lines in Canada! Now that’s encouraging. If something as simple as a tree can put 50 million people in the dark...

Or consider the Millennium Bug. No one will ever know what would have happened if computer experts hadn’t taken precautions. But the forecasts were bad: on 1/1/2000, computer systems would go berserk. Bank accounts would empty themselves, data bases be lost, power stations would fail, nuclear missiles would decide to launch themselves. Gladly, all of this didn’t happen. But what if someone released a computer virus which, say, told our computers it’s the year 3000?

As our reader puts it: "That automation is coming, and coming fast. Home automation is here already (albeit pricey and unreliable for now) and will improve by leaps and bounds quickly. Internet-connected everythings are being sold everywhere. We're even taking baby steps into fully-automated factories and fully-automated transportation systems. (You really don't want to know how planes are guided these days.) And sometime within the next century the turning point will come. We will become so dependent upon the Machine that its absence will kill us."

ROBOTS – 2040 to 2050

Be afraid. Be very afraid. Somewhere over the next decennia, robots may decide to kick all humans off the planet. Oh, you always held that for science fiction? A growing number of dead serious computer scientists disagree.

It all happens quite suddenly. The one day, everything looks like it's supposed to be. But the next day -- there's war.

As you draw back the curtains in the morning, you’ll find the streets full of chaos and despair. A traffic robot unit chases your neighbor Macy across the streets. The robotic sales unit from the grocery store around the corner holds the shopkeeper down to the ground. And look, there's your friend John, he's chased by one of those automated school busses!

Then, you hear a rumbling sound. From the far end of the street, a platoon of big, greenish black robots marches in. You recognize them from TV: they're the robots Defense uses for strategic military operations. But this time, the robots seem to operate all by themselves. Systematically and with extreme precision, they rid the town of humans, shooting everyone they encounter.

Slowly, you step back from the window. You rub your eyes. This must be a dream, you tell yourself, yes, an oddball nightmare, what else can it be? But then, a crippling burst of pain shoots through your body. As you fall to the ground, soaking in blood, you turn your head. There, right next to you, is your devoted household robot Nelly. She’s holding your brand new kitchen knife, uttering weird beeping and humming sounds of pleasure...

Okay, okay, so I let fantasy take over a little. But wait. Robots waging war against their creators no longer belong to the realm of science fiction. In fact, the subject pops up on more and more dead serious scientific robotics congresses.

Admittedly -- household robots, Defense robots and automated school busses don't exist yet. But that is changing rapidly. Already, robots build our cars, run our production lines, help our surgeons in operations, dig for oil, clean our sewage pipes, explore distant planets, disarm land mines, fly airplanes, entertain our kids -- yes, they even drive cars around, albeit on experimental test tracks only.

There's absolutely no doubt robots will become ever more important. They will fight our wars, cook our meals, take care of transportation and even satisfy our sexual needs. As long as there's a demand and money to be made, new robots will show up, taking care of an ever-growing list of tasks and jobs.

But the real revolution will come from Artificial Intelligence: computer software that is capable of learning by itself. As we speak, Artificial Intelligence is undergoing a BIG revolution. From data storage programs that learn how to make sense out of human voices to computers that learn how to recognize alien life forms (no, really!) -- it's all there. And the combination with robotics is, of course, also made. As we speak, the first artificial intelligent robots are learning how to perform simple tasks, such as steering around objects or plugging themselves into a power point before their batteries run out.

So, is the world becoming a better one? A lot of people think so. But wait, there's a BIG problem here.

The next-generation robot will make up its own mind -- literally. It will acquire huge amounts of knowledge, simply because computer brains hold more information than human brains. It will think faster, learn faster, and outsmart us many, many times -- some AI-scientists estimate that within only some twenty to thirty years, an everyday robot will outsmart humans by several BILLIONS of times. And although it

is speculative, many experts believe the robots will even develop something like a consciousness.

So there we are, surrounded by super smart computers on legs that may even have a certain kind of awakening consciousness. It will give a lot of people the creeps.

According to the Belgium robotics pioneer Hugo the Garis, who makes a hobby out of preaching doom and destruction, this will cause war. It will be the `haves' against the `have-nots'; the people who have the robots against the people who don't. The latter group will want to smash all robots to bits; the first will firmly believe that robots are essential for human progress. As De Garis coined it, it will be a war between the `Cosmists' and the `Terrans'. Of course, chances are the `Cosmists' (the ones with the robots) will win. After all, they have at their disposal armies of super smart, invulnerable robot warriors. Millions will die in this unprecedented, unique, and undoubtedly very bloody World War.

But hey, that's not the biggest problem.

Our robots will have different needs than us. To put it bluntly: a human runs on food and drink, a robot needs power and oil. But there's no need for humans to take care of robot needs. That, after all, is what we have robots for! So it's more likely we'll have robots that repair and feed other robots, and more robots that take care of the production of electricity and oil. In effect, this means there will be a split between our own, human economy, and an entirely separated robot economy.

And it goes well beyond that. Weird as it may sound, chances are the robots will develop a separate robot society. Let's face it: there's not much we can offer an artificial intelligent robot, right? Compared to the robots, we are `off-line' a considerable amount of time every day as we sleep, we make bad chess players, and we probably won't be able to offer the robot much entertainment.

So, what will an artificial intelligent robot do when we DON'T use it? Probably, it will hang around a little. Perhaps it will play a game of super fast chess with another robot. Maybe it will contact some fellow robots, chitchatting about nothing in particular, like Fermat's last theorem or string theory. One thing's for sure: it's very likely the robots will give shape to a separate, entirely new society on Earth, now that humans have become so boringly slow-witted.

Also, the robots will come up with new plans. They will design new technology, work out novel theories, create new space programs, set up undreamed of science experiments to find out more about nature. And yes, they will invent and build new robots to do it. More and more, the robots will go their own way, becoming completely independent of humans.

Perhaps a war of robots versus men will be inevitable in the end. Let's face it: once the artificial intelligent robots hit the scene, humans are the annoying species on

Earth. We're imperfect, quite uncontrollable, irrational and prone to all kind of errors and system failures. And besides, we waste robot time with our constant requests for food and production.

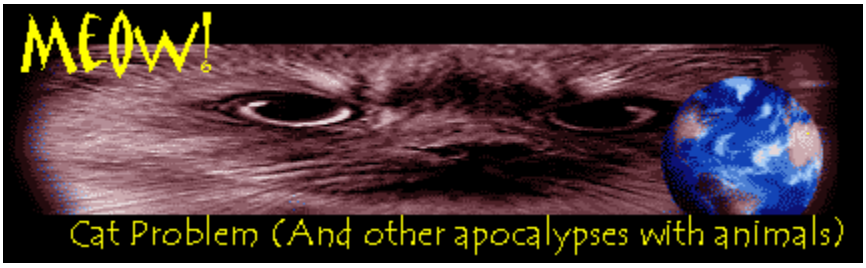
Sooner or later, it's more than likely the robots will decide they've had it with humanity. They will take over. They will send some robot troops into town, execute the bigger part of us, and put the rest of humanity behind bars, for scientific testing, or merely for entertainment. There will be human zoos and human testing facilities. Everything will be the other way around. This time, we will be the ones doing the dirty and the dangerous work for the robots. Who knows they'll even use us for batteries, like in The Matrix!

But also, there's an alarming possibility the robots decide the world is better off without humans after all. Humanity will be simply eliminated. Good riddance, the robots will say to each other. We might call the robots rebellious. But the robots would think otherwise. After all, humans are the ones who run amok all the time, against nature, against fellow humans, or against the robots. Humans are by far the less reliable species.

Oh, but surely, there will be a way of keeping the robots under control, you might say. We'll program the robots so that they'll never, ever mess around with a human being. We'll simply install some kind of big red switch, enabling us to turn all the robots off?

Well, that may be a bit of a problem. When we think of robots, we usually think of the rather clumsy, hydraulic machines that stumble mutely around in our factories. We're just NOT used to the idea of Artificial Intelligence robots walking the streets. And one thing is for sure: it is very unlikely a generation of robots that is capable of outlearning humans billions of times will be fooled by some prime directive or a red switch. So when those first AI robots come to help in your home, better lock away your kitchen knives!

PETS – any day now



What's furry, has claws and triggers the end of the world? You guessed it. It's your trusted, feline friend: your cat. And cats are not the only animals

causing problems. Rabbits do it. Frogs do. Yes, even the cute Giant Panda is helping to blow the world to kingdom come. Sit back -- and shiver!

If you felt sorry for the dinosaurs, consider this. At this very moment, we're in the middle of a period of mass extinction that's actually WORSE than the one that wiped out the dinosaurs. You read that right. More species go extinct at this very moment than during the last days of the dinosaur!

You see, it took the dinosaurs thousands of years to die out altogether. Today, the speed of extinction is higher -- much higher. Each day, an estimated seventy species go bust. That's seventy species! Gone. Not to be seen ever again. A few centuries more, and half of all species will no longer be here. Thanks to the meteor impact called 'mankind'.

Now, that IS a problem. In nature, everything is linked to everything else. Everything that lives relies on other living things. And the really bad news is, of course, that we are also part of nature. What would we eat if it wasn't for our crops and livestock? Shoes? And what would we breathe?

It would take a library to explain what exactly is happening to the animals and the plants on our planet. For now, some brief highlights will do, just to show you how serious and weird matters really are. So enter the cats, the frogs, the snails, the insects - the whole zoo.

File # 1:
The Case of Osama Bin Leopard

Remember Afghanistan? In 2002, the US army used cluster bombs and oxygen sucking fuel bombs to rid the Afghan caves of Al Qaida bad guys. Unfortunately, someone else was hiding there too. That was the snow leopard, one of the rarest animals on the planet.

Just picture it. Osama's bearded boys, holding hands with the mighty snow leopard in some cave. Then: BOOM! BURN! CHOKE! Bye-bye boys. And bye-bye snow leopard.

But while there are plenty of bearded boys left on the planet, the same cannot be said of the leopard. The animal has probably gone extinct in Afghanistan by now -- a by-product of war. Few people know of it. And even fewer seem to care. The mighty predator of the mountains happened to be a stand in the way in a silly human war over religion, power and such. At this moment, there are an estimated 5,000 snow leopards left on the planet. That could be too little for survival.

File # 2:
The Case of the Evil Cat

As I write this, Molly the cat is on my lap, having a nap. Lizzy, my other cat, is outside, chasing birds, or picking a fight with another cat. You see, my next door neighbor has two cats as well. The neighbors on the other side have three cats, the neighbors after that have five. In the street where I live, there are more cats than people!

And that is a problem. All those cats catch lots of birds and mice and rats and butterflies. Biologically speaking, cats are eating a huge hole in the food chain. No, seriously! According to several alarming reports, this is exactly what is happening in countries like the United Kingdom, Sweden and my own country, Holland. Bird species are vanishing, mouse subspecies are going extinct. All because of Molly, and Lizzy, and the other many billions of domestic cats that inhabit the planet today.

Where would that all lead? A planet, exclusively inhabited by cats and people? Hmmm. Just take a guess. My cat Molly has left my lap now. Probably off to catch another mouse.

File # 3:
The Case Of The "Cute" Panda

Humans are a friendly species. We like animals. That's why we can't stand it the Bonobo monkey and the Giant Panda are about to go extinct. No way we'll let the beautiful lion, the cute chimpanzee or the impressive elephant go extinct! We build another natural reserve.

But hold it. In fact, the species we adore are only a slight minority. Who cares for snails, insects, snakes, lice, or spiders? These species are in trouble, too. But they're not cute enough. Humans simply don't like them. We'll let them go extinct, and won't miss a night's sleep over it.

'Survival of the cutest', is the word for that. Biologists use it sometimes when they argue that we're protecting the wrong species. On our lists of 'endangered species', there are plenty of beautiful and furry and funny animals. But no snails, cockroaches or flees. Not to mention the microbes, that are by far the most important species on Earth.

File # 4:
The Case of the Dead Frog

It is a mystery. Everywhere in the world, frogs are dying. There seems to be no specific reason for it. Everywhere around, they're just kicking the bucket, for no apparent reason. There you have it: the frog problem.

It could be pollution. It could be the hole in the ozone layer. It could be a fungus. It could be acid rain. It could be all these things combined.

Whatever the reason, biologists are very worried. Apart from the fact that a frogless world would be a rather empty place, the frog problem could be some kind of warning. Frogs are known to be quite vulnerable. So who's next? Us?

File # 5:
Invasion Of The Killer Rabbits

The dingo did it. So did the rabbit. They invaded a place where nature never meant them to be.

Well, `invaded' isn't the right word, really. Humans brought them over, of course. The Dutch brought their cats to Australia. The British took foxes and dogs to New Zealand. The mighty Vikings introduced the cute rabbit in Scotland. The gypsies took the gypsy moth to the US. And now, there's trouble all over the place. Down under, there aren't suppose to be any predators. In the US, there aren't suppose to be any gypsy moths. Nature just didn't expect it.

So disaster strikes. In the US, about a fourth of the agricultural gross national product is lost each year to foreign plant pests such as the dreaded boll weevil (from Mexico) and the leafy spurge (brought by Europeans). In New Zealand, Australia, Scotland and many other countries, zillions of rabbits drive the locals insane, digging about like crazy.

Not to mention those evil, evil cats again. In New Zealand and Australia, the cats gobble up rare birds and mammals. Such as the poor, innocent kiwi bird. For crying out loud, the poor thing doesn't even has wings! Evolution thought that without cats, there was no need for wings. But evolution got it wrong.

It isn't a nice thing to say, but the real problem is mankind. Humans are in the habit of messing up everything they do everywhere they go all of the time.

They are a harmful species, these humans -- almost as harmful as cats.

HOLOGRAMS – any day now

Could someone or something switch us off? Could it possibly be true that our world is just a computer program, or a hologram, or a dream? Although it's about the weirdest thing you could think of, there are some tantalizing clues this might indeed be the case. The stuff we call 'reality' simply isn't very real after all.

Welcome to the outskirts of reality. Welcome to the place where theoretical physics and philosophy meet, and where religion and science loose their meaning. Better fasten your mental seatbelts. What we're about to tell you is just too weird. Too mind-boggling. And quite disturbing, really.

Here we go: *the place we call reality may not be real at all*. It may look real, and feel real, and smell real. But if you know where to look, and you look real close, you can see the cracks. Just like a Hollywood actor that suddenly realizes he's not surrounded by real buildings -- but by props made of cardboard paper.

If that sounds like lame science fiction; I agree. Indeed, we've all seen The Matrix. But could such a thing be conceivable? Could it be true? Are we really here? Or are we, as one reader of Exit Mundi suggested, only a computer simulation, run by an alien race?

Perhaps the simulation is getting boring, and the guy running the program is about to switch it off. We'd see some kind of huge 'game over'-sign, and that would be it. One moment, we're here. And the next – we aren't.

If you're easily disturbed, or prone to paranoia, better stop reading now. You may not like the answers to questions like these. What you are about to read may change the way you see things -- forever.

Why is the Universe Fine-Tuned?

First, there’s a very, VERY peculiar thing about the place we live in – something so weird and profound it sends shivers down your spine. For in fact, the Universe seems to be ‘fine-tuned’ to make life possible!

It has to do with the stuff most people find boring in school: the laws of physics. Ultimately, all of these laws are founded upon the ‘physical constants’. Such as the force of gravity, the ‘strong force’ that glues atomic nuclei together and the electromagnetic force, the driving hand behind stuff like lightning and computers. But why do these fundamental ‘presets’ have the values they have? Why aren’t they a little bigger, or smaller?

The British cosmologist Fred Hoyle was the first to realise this is no coincidence. A very peculiar thing about the fundamental constants is that they appear to have *exactly* the right values. If they were slightly smaller or bigger, atoms, stars, planets and people simply wouldn’t exist!

Take the strong force inside atomic nuclei. If the force were just slightly stronger, it would boost up the burning of stars so much, that they would explode only seconds after they were formed. We wouldn’t have a sun – or even a planet. If on the other hand the force were a tad weaker, it would be too weak to hold together elements like the heavy hydrogen isotope deuterium. Stars wouldn’t light up. And we wouldn’t be here either.

Astonishingly, the same goes for *all other constants*. As the famous British astronomer Martin Rees put it: “Wherever we look, we see examples of fine-tuning. Most of the physical constants and the initial conditions of the Universe examined so far appear to be fine-tuned to some extent.”

That leaves us with a gnawing, unsettling question: Why? Why are *all* physical contants *exactly* the way they are? Every cosmologist agrees that this can hardly be a coincidence. So what, or who, set the rules?

Matter: Chunks Of Music?

Next, you should know the stuff our Universe is made of isn’t very real at all. Sure, you can feel the chair underneath you, and see the monitor in front of you. But what we feel and touch and see in everyday life is actually a manifestation of some deeper, completely different kind of underlying reality.

One way to explore what matter is, is to take it apart. First, you'll find tiny chunks of matter that are called molecules. Then, if you take the molecules apart, you'll find the atoms the molecules are made of. And then, if you take apart the atoms, you'll see it's made of a nucleus, surrounded by a cloud of electrons. And what if you take apart that nucleus? You'll be in for a big surprise. For inside an atom's nucleus, reality as we know it actually ceases to exist.

An atom's nucleus is made of tiny entities we call 'particles'. But that's just for lack of a better word. When you say 'particles', you think of little balls. But in quantum physics, there's no such thing as solid `balls' you can touch or see.

In fact, 'particles' like quarks, electrons and photons are so incredibly and utterly different from everything we know of, our language lacks the words to describe them. Particles can be in two places at the same time, and behave both like a wave and a tiny chunk of matter, depending on what you do with them. Particles can pop in and out of existence from nowhere. And 'grabbing' them is impossible: it is simply not possible to both know where a particle is and how fast it moves about.

But still, a particle has to be *something,* right?

That's why more and more physicists turn to `string theory'. In string theory, matter is ultimately made of extremely small elastic circles, called strings. These strings vibrate. But not like anything we know: the strings vibrate in at least ten dimensions! Our particles are the vibrations of the strings. They are the music the strings make.

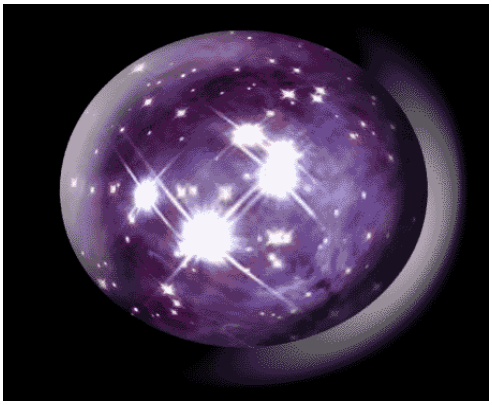
The Universe: Bubbles Of What?

Okay, hold that thought: *matter is ultimately the manifestation of something else.*

Gladly, there are also things that are *normal*. Take the Universe. Again, it is something we think we know. The Universe is that big black thing with all the lights in it over your head. Perhaps you've even heard it's expanding: first, there was a kind of blast (called the 'Big Bang'), and from that moment on, the Universe grew bigger and bigger.

But hold it right there. Once more, the real story is far stranger than that. For starters, the Universe has no 'outside'. To ask what is 'outside' the Universe is a meaningless question – it would be like asking what continent lies 'outside' our planet. 'Outside' the Universe there are no dimensions, and there is no time. The Universe is best seen as an expanding bubble of dimensions in a sea of nothingness

– although ‘nothing’ isn’t really a word you can use to describe what is ‘outside’ the Universe.



It is extremely difficult to fully comprehend what that means. According to one theory, there are many dimensional bubbles like the one we live in. Our Universe could be the result of two of such bubbles – or ‘planes’ – colliding. And wait, now you’re doing it again: you’re picturing a place with bubbles floating around. But there’s no such thing as a ‘place’. Instead, the other Universes should be wrapped up within our own reality, remember?

An even more bizarre theory has it the place we call the Universe is actually best compared with a hologram. Our Universe could be some kind of optical illusion, the result of several dimensions resonating.

And it goes even further. For in fact, it could actually be possible to create a Universe! Basically, the only thing you’d have to do is squeeze a huge amount of energy together into a very dense, small spot. This would lead to a Big Bang, the theories predict. We wouldn’t see it happening: the Big Bang would create a new dimensional bubble, far beyond reach of our own bubble.

OK, let’s pause for a second. Just think about it. Is it possible that our reality is actually *made* by some other civilisation, in some other Universe? It would explain why the fundamental constants are fine-tuned…

And You? How Real Is Your Mind?

So, to wrap things up: we live in a place that’s not really a ‘place’, we’re made of stuff that’s not really ‘stuff’ and what we see is only a small part of what’s really there. Matter, time, dimensions, the Universe – it’s all lucid, unreal. And to make things even more bizarre, for some reason, our Universe is exactly preset to make our existence possible. Pretty confusing, don't you think?

Gladly, you can cling to this one security: that *you* are here. No matter how weird the stuff around you is, *you* are definitely for real. No need to explain: you

just *know* you are.

But do you really?

Let’s do an experiment. Speak out your name over and over and over and over again. After a while, you’ll notice something weird. Your name will begin to sound strange. It’s no longer something that is you – your name is just a word, a random sequence of syllables and sounds that other people utter when they want to catch your attention. If your parents had given you another name, you would listen to another sequence of sounds.

The same happens when you look in the mirror. Stare at your own face long enough, and you’ll suddenly realize it’s just another face. The face in the mirror is, of course, yours. But after a while, it won’t feel like that anymore. The face you see could be anybody's.

Most neuroscientists agree the same applies for your consciousness. The thing you call your ‘self’ is most likely an illusion, created by your brain. Your brain gives you vision, sound, speech, feelings, and thoughts. When you add all these things up, you’ll have some overall feeling of awareness you call your consciousness. But still, your brain is the thing running it. Your feeling of ‘self’ is best compared to a software program running. It looks very real – but it isn’t.

Of course, most people believe there is something like a ‘soul’ or a ‘spirit’ living inside of you. But when it comes down to facts, there just isn’t any evidence for that. Every thought you have, every move you make, every emotion you feel - it’s just brain, brain, brain.

There are actually experiments that *prove* it. When you disturb your brain in a certain way, your feeling of ‘self’ can get detached from your brain. Suddenly, it will feel as if ‘you’ are not inside your body anymore. You experience what is known as an ‘out of body experience’, or a ‘near death experience’.

But you don’t have to be nearly dead to feel it. The sensation can easily be created in a laboratory, by placing a helmet with rotating magnetic fields on your head. The magnetic field acts like a ‘jam signal’ on your brain. Suddenly, you'll feel like you're floating outside your body. But you aren’t. It’s just your brain going confused.

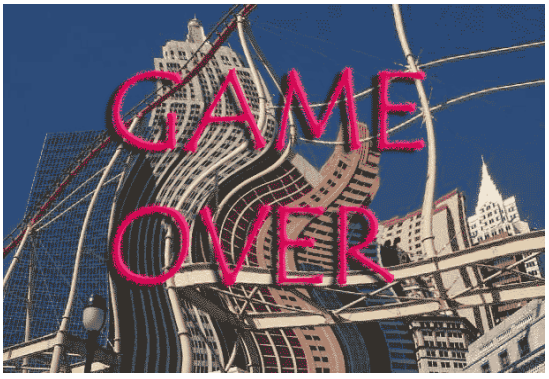
And you don't really need a helmet to do the trick. Visiting a place where the movement of the Earth's crust generates magnetic fields can give you the experience. Being in a situation where your brain doesn't get enough oxygen sometimes does it. Certain brain operations bring out the experience. Meditation and intensive prayer can generate it.

In fact, exactly this is why some people see ghosts, or Maria, or feel like they are visited by aliens. It is an incredible weird experience to be ‘outside of your brain’. Your brain will try to make sense of it. Immediately, the rational part of your brain will come up with an ‘explanation’ for the experience. You will sense a ‘presence’ near you. If you’re religious, you might see Maria, or Jesus. If you believe in UFOs, your brain might tell you you’re visited by aliens. If you believe in ghosts, you’ll feel the presence of a ghost of a dead person. But in reality, it’s your own feeling of self you’re experiencing.

So... Are We A Game Of Sims?

So there you are. You’re just a walking piece of matter that’s pretending to be someone. But in reality, things like matter, or self, or the Universe, or time, or dimensions are all illusions. Everything we see and everything we feel are, in fact, the manifestations of some underlying reality.

That leaves you with an unsettling question: what exactly *is* that reality?



The truth is: we don’t know. Could be almost anything, really. A dream, even. Or a simulation. Or a kind of computer game, an advanced kind of *Civilization* or *Sims.* There’s no way of knowing if there’s someone or something pushing the buttons. There’s no way of knowing if there *isn’t*, either.

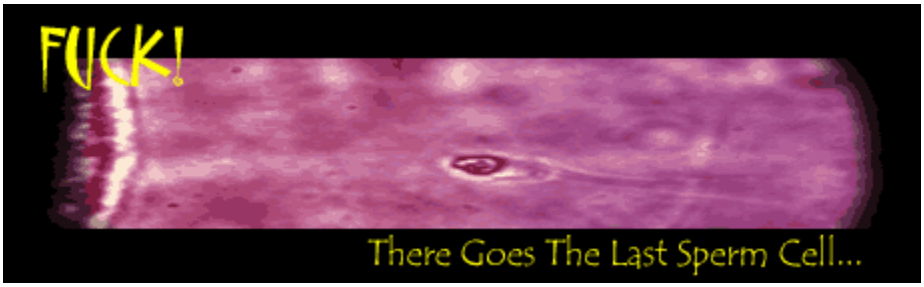
And then, there’s this other thing most theorists agree on: our reality could suddenly *end*. Our universe could fold up. The dimensions we live in could be wrapped up. The very fabric of our physical world could be disrupted by some unprecedented, weird physical event. From one second to the other, our reality

would no longer be there. Sounds like fun, right?

But then again, why bother? For that’s the deeper consequence of these things. If there is no such thing as a place we call Earth, we needn’t really worry about its end. Would the characters of a Sims-game feel sad or disappointed when you turned off the computer? Or would the people you dream of at night mind if you wake up? You guessed it: they probably wouldn't. What isn’t really there, doesn’t really end.

That being said, there’s only one small problem. You see: you have to be a good philosopher to really feel it that way!

IMPOTENCE – AD 2100 to 3000



It would be a bit of an anticlimax. Instead of some huge catastrophe doing us in, humanity may simply go extinct all by itself. Actually, the Big Decay may have already begun. Human fertility seems to be declining frighteningly fast. A couple of generations more -- and the human race could be history.

You would hardly notice it at first. Gradually, street life is becoming calmer than it used to be. Less people, less traffic. It’s a relief at first: no more housing problems, no more traffic jams, no more queues for the movies.

But after a while, your cheerfulness subsides. Slowly it begins to dawn on you what’s happening. You’re witnessing the demise of a species -- *your* species, to be precise. Humankind is about to join the Dodo, the Woolly Mammoth and the Neanderthal Man. The human race is heading for extinction.

OK, so you decide you’ll have kids, in an attempt to turn the tide. But then the grimness of the situation really lashes out at you. No matter how hard you and your partner try – no pregnancy. You turn to one of the fertility clinics that are by now very common. But the doctors can’t help you out. You’re infertile, the two of you. If

you’re a man, you’re the one to blame: your sperm is of no use. You can have sex all you like, but your semen just doesn’t do the trick.

It’s a generation or two later. The world has changed completely. The fertility clinics are all deserted now – well, there’s animals living in them, and weeds growing all over them. In what used to be crowded streets, trees now grow. Wild dogs and rats stroll the deserted cities. Erosion gnaws at what used to be buildings. And outside the city, roads and farms lay barren, like a fading memory of what once was.

Abandon all hope - When humanity's gone, it will take nature something like fifty years to completely overgrow everything we ever built.

Sure, if you look hard enough, you’ll find some small pockets of humans that still survive. Mankind is a bewildered species by now, largely outnumbered by the birds, the rats, the dogs, the wolves perhaps. And the human species is degenerating fast: there are so little people left, they inbreed all the time, giving birth to children that are ever more mentally retarded. *If* they give birth to any children at all, that is.

But in the end, there’s no survival. Human is simply no longer viable. There will be a last group of humans – and then, the very last human being. Eventually, the last human gets old and dies. And that will be it. There will be no more laughter, no more voices, no more thoughts. The only thing left is a couple of ruins, scattered over the face of the planet.

Feel sad already? You should. The slow extinction outlined here is definitely one of the most depressing Apocalypses you could think of. Well, the good news is we aren’t about to witness it any time soon: with *five billion* people living on the planet today, overpopulation is more of a problem than extinction.

But that could change. Actually, the first signs of the Big Demise are already here to be seen. Men are becoming less fertile, several studies indicate. In only fifty years time, the number of sperm cells per milliliter of semen has halved, from 113 million cells to 66 million. Sure, that’s still a lot of sperm cells. But it could also mean that in another fifty years, men will no longer be able to make any babies at all.

Last Man Standing: The last human will be truly alone on the planet

It’s a big mystery why male fertility is declining.Many researchers blame the pollution: there’s all kinds of chemicals everywhere, in the air and in our food, and we just don’t know exactly what all these substances do to the

human body. Others blame the human habit of wearing clothes: men have their testicles outside their body because sperm can’t stand high temperatures, and pants and underwear undo this. Clothes warm up your balls, so to speak.

A more exotic – and frightening – theory has it that evolution itself is turning against us. In nature, the biologically `fittest' individuals survive, leading to an ever more `fit' offspring. But among humans, this works different. How many kids you get doesn't depend on biology, but rather on where you live and what culture you’re in. Western city-dwellers get less kids than inhabitants of traditional societies. It doesn't matter who has the best sperm; the Not-So-Fit survive as well. So basically, the biological quality of our species may be in decline -- and the sperm problem could be a result of it.

Oh, it is probably a combination of things, the demise of our fertility. The chemicals, plus the ball-warming pants, plus the evolutionary knock-back, plus who-knows-what. Whatever the reason, we should worry. If the present trend continues, we could be history well before the next Millennium.

And it doesn’t help that the decline of our species is sped up by demography. More and more people adopt the industrial, Western lifestyle: more women working rather than having kids, and with reliable contraceptives widely available, more and more couples choosing to have children at a later age -- and less children. Eventually, this trend will lead up to the point when the number of humans will no longer grow, and actually start to shrink. The turning point is supposed to be around the year 2150.

So bring out the clones, you say. If we’re running out of humans, just make some new ones in a laboratory somewhere. Oh, come on, be real! Cloning doesn’t work as well as the media and the scientists like us to believe. What they don’t tell you in the news papers is that most clone attempts simply fail. For example: it took *two hundred* attempts before CC the cat, the world’s first cloned pet, came along. And then there’s the still insurmountable problem of old age. You see, old age is locked in your DNA. So your clone will look like a baby, but its DNA will be as old as you! So by the time you die of old age, so does your clone. It’s as simple as that.

So... We're doomed, right?

Well, not necessarily. Here’s the light at the end of the tunnel: the claim of science that men are becoming infertile may be dead *wrong*. The findings of the sperm counting studies are still controversial. One study says we’re doomed, the next study says that’s all rubbish. It will take some time before we know for sure what’s going on – if there’s anything going on at all, that is.

But don’t relax yet. Our species has a reputation for being not particularly good at reproduction. One out of four couples have serious problems getting pregnant. And even if you have sex at the height of female fertility, there’s only 10-20 percent

chance of pregnancy. That's probably the reason why humans are the only mammals that have sex throughout the year, instead of only during spring. Now, given these problems, you just DON'T want our species to become less fertile as well.

And then there's this. We already mentioned the possibility that chemicals render us infertile. But yet, we come up with ever more chemicals. And it doesn't help that the atmosphere's cleaning up system that rids us of pollution is on the verge of breaking down (in a so-called `hydroxyl collapse' – coming soon on this site).

Finally, there's the eerie possibility our technology makes us infertile by mistake. As we write this, the US biotechnology firm Epicyte experiments with a new breed of contraceptives: corn that is designed to render the men that eat it infertile. And as we explain elsewhere on this site, there's a real possibility lab crops like these `escape' into nature, turning more and more crops into contraceptives. It would be some choice. Either you starve, or you go infertile.

Some fucking dilemma, if you ask me.

DEMOGRAPHY – from AD 2060

You may not have noticed it, but at this very moment humanity is going a little… well, *extinct*, really. For the first time in history, our species is in decay. A handful of centuries more, and it could all be over.

This time, the doom saying doesn't come from some wacko prophet. No, it's high-ranking UN-officials and respected economists that ring the alarm bell. The extinction we're dealing with is locked away in alarming government reports and ill-omened scientific statistics. Far too few people read them.

Here are the figures. By the year 2100, 83 percent of all Spaniards will be gone. There will be 86 percent less Italians, while in Germany, only 17 percent of the population will be left. And how about this one: three generations from now, there will only be half as many people than today.

The doing of some kind of virus or climate mishap? Far from it. This time, the extinction goes all by itself. `Demographic meltdown', is what they call it. Or `birth collapse'. Or `baby bust'.

It goes like this. On average, a couple should have at least two children to ensure the continuation of the species – or more precise: 2,1, to compensate for children that die early. But all over the world, couples decide to have fewer children. From 2050 on, this will cause the world's population to shrink. And shrink, until there may be no one left.

So why on earth would humanity want to do that? The reasons are manifold. And in fact, quite understandable. In the old days, you needed children to work on your farm, and to look after you when you grew old. You needed lots of them, because many children died young.

But with better health care and with social security, that's all changed. You don't really *need* children anymore. What's more, when you live in a city, children cost you time and money. Besides, more and more women work. They'll have children at a later age and bear fewer children – if they decide to have any children at all, that is. Anti-conception has nothing to do with it. A religious lifestyle doesn't stop the trend either. It's just the course of history that's doing us in.

Not impressed yet? Please let us throw some more figures at you. At this very moment moment, the populations of over sixty countries are falling. Fifty years ago, women throughout the world on average had five children. Today, the average has diminished to 2,7 kids. And all the experts agree on one thing: that's just the beginning.

Obviously, this will change the world we live in completely.Expect a world where everybody's ageing and youngsters and children are becoming rare. Expect empty streets, and empty stores. Expect the world economy to come to a grinding halt, as there are less and less people around to buy stuff. Expect governments urging their people to have children, for heaven's sake, please do! Expect a world where every country is begging third world immigrants and refugees to come over.

But then again, no immigrant would come. The statistics show that the baby bust also strikes in the poorer half of the globe. In Asia and China, birth rates are falling alarmingly fast. In the Southern Americas – the same story. Africa is the only continent where the birth numbers are still high. But then again, the AIDS epidemic causes people to die at an early age – and this actually is slowing down population growth tremendously.

Oomph oomph

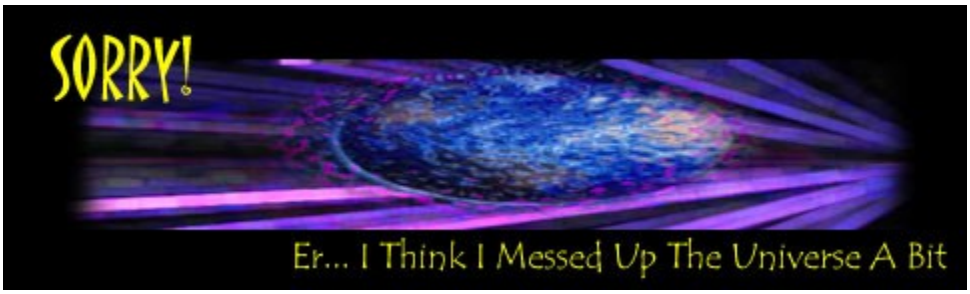
That’s neat, you say. So we’re about to join the Woolly Mammoth. Exactly the sort of thing you wanted to hear when you thought to relax a bit while surfing the web, right?

Well, here’s something to cheer you up a little. In fact, it’s very hard to say if the baby bust that’s hitting us today will actually bring about the end of the species. With six billion people around today, we don’t exactly have to wet our pants yet. And then there’s this: 70,000 years ago, when humanity was still wearing bear skins and saying ‘oomph, oomph’, humankind also survived near-extinction. Back then, a supervolcanoerupted and cut humanity down to a slim total of 10,000. But we survived all of that.

On the other hand, there’s absolutely no indication the trend will change. With fewer and fewer people around, women will be under even greater pressure to find a job – and have even less children. We can be sure about one thing: women will never ever again voluntarily have themselves locked away in their role as child-attendee and kitchen maid.

And then there is this other nagging problem. As explainedelsewhere on this site, there is a possibility men are becoming less fertile. Just picture it: a world where women don’t *want* to have children, and men just *can’t*. Now wouldn't that be a pity?

Q – COLLAPSE – AD 2020



Alright, so accidents happen. But the accident that happened today is a rather awful one. Scientists triggered the end of the Universe. By mistake, that is.

It was all supposed to be under control. Sure, in the 1990s, there were some oddball scientists who gave off warnings that things might one day
go terribly wrong at the lab. But no-one really cared.

Unfortunately, the oddballs were right. Today, during an experiment in high-energy physics, the inconceivable happened. The experiment triggered what scientists call a **quantum vacuum collapse**. And one second later, the dreaded phenomenon

has wiped out all matter on the planet. The world with everything and everyone on it has simply ceased to exist.

But that's not all. Traveling at the speed of light, a huge wave of destruction sets out from where the Earth used to be. Like the shockwave of a bomb exploding, it flings off into all directions. And everywhere it passes, it brings about mayhem and destruction. Voom! -- there goes the Moon. Slam! -- that was the Sun. Spat! -- Mars, Jupiter, Pluto; all gone. The shockwave never stops. It will expand and expand. And expand, until every molecule in the Universe is dead.

So, what exactly is going on? The answer takes you to the heart of**quantum physics**: the chunk of science that deals with the tiny particles that make up everything in the Universe. Quantum theory predicts that the Universe is filled with so-called **vacuum energy** -- which is the average energy of all those zillions of particles that pop into and out of existence everywhere around us each moment. As the Universe expanded, the vacuum energy dropped down to the lowest possible level. Well, in theory, that is.

There is, however, a small possibility that the theory is wrong. The Universe may be still `hung up' in an unstable energetic state. If so, a fierce jolt of energy in just the right place may be exactly what it takes to tip the balance. It would be like putting a needle into a balloon. Within a fraction of a second, a HUGE blast of energy will set free, as the quantum vacuum plunges into a lower energetic state.

The destructive energy that is unleashed will be quite different from everything we know. Literally every atom in our part of the cosmos will spew out energy. You can't even BEGIN to imagine the bizarre consequences this would have. For one thing, ordinary matter will become unstable and cease to exist.

So what would spark off the collapse? Well: particle accelerators, for example. In a particle accelerator, science smashes all kinds of tiny particles into each other to learn more about matter and the Universe. Now that's neat -- but according to critics, there's a real possibility such collisions may yield enough energy to push the Universe off balance. `The Universe can be blown to smithereens', as one of them (Paul Dixon) cosily put it in 1998.

If you find all this hard to understand, don't worry. Even specialized physicists don't fully understand how the quantum vacuum works. So their line of reasoning is simple: everywhere in the Universe, all kinds of atoms, molecules and particles slam into each other constantly. So if the quantum vacuum indeed were unstable, it would have had plenty of opportunity to collapse already. Simply put: the Universe cannot be a barrel of gunpowder, since nature constantly throws all kinds of burning fuses into it.

Phew, that indeed seems reassuring. On the other hand: as some physicists have pointed out, there is also a possibility nature simply hasn't found the right fuse yet. And here on Earth, we're experimenting with all kinds of new fuses -- for example, we're doing and planning particle accelerator experiments with rare elements such as gold and with elements that are so unstable they don't exist in `real' nature.

What's more, accidents happen. And the bigger the science, the bigger the accidents. So please, dear physicists. If you read this, please be a little careful.

Q – ENERGY – any day now

There's a fuel supply that is costless, unlimited and that gives off no pollution at all when you use it. There's just one minor problem. When you try to use it, you may accidentally blow up part of the Universe.

It will be over before anyone can say `sorry'. In a laboratory somewhere, someone tries to get hold of a weird and completely new, exotic type of energy. But boy, the experiment goes out of hand. Suddenly, there's a BIG explosion.
And then there's nothing -- our planet, the sun, all planets in our solar system and even some stars surrounding our solar system have been blown to smithereens.

And explaining what went wrong isn't even simple. We're talking **quantum physics**here: the physics of the vanishingly small building blocks that make up all matter in the Universe.

In quantum physics, everything is totally different from daily life. Quantum particles can be in two places at the same time, and can behave both like waves and particles. In fact, when you hear a quantum physicist say `particles', don't think of little, round balls. Quantum `particles' are better compared with tones of music: they're definitely there, but you can't see them or catch them.

One of the most mind-boggling properties of quantum particles is that they come into existence out of nowhere. Suck every molecule of air out of a bottle, making it completely vacuum -- and quantum particles will still be there. They pop up in pairs out of nowhere. And within a tiny fraction of a second, they merge together and -- zzzip! -- they're gone.

It is precisely this odd `quantum vacuum' that may one day open the door to a very new source of energy. Suppose you're able to snatch some of those out-of-nowhere particles away. Admittedly, you'll have to be REALLY fast. But if you do succeed, you'll have harvested particles out of nowhere. And since matter and energy are basically the same stuff (according to Einstein's $E=mc^2$), you'll have energy out of nowhere!

The advantages would be unimaginable. Here's an energy source that never runs out, is everywhere around, is extremely cheap, and causes no pollution whatsoever.

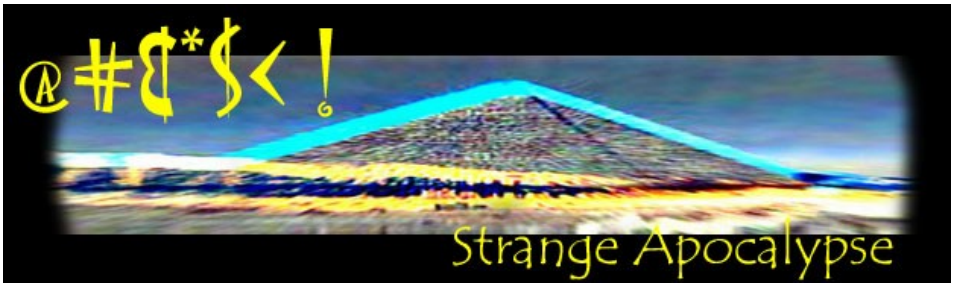
But then again, there is a small, but alarming risk. There may be simply energy **too much**. Mining the quantum vacuum might bring about an unstoppable chain reaction, releasing an ever increasing amount of energy. In fact, no-one knows how much energy will be released: calculations done by physicists give answers anywhere between zero and infinity.

Obviously, too much energy would mean trouble. The explosion could be huge enough to blow apart our entire solar system and everything around it. And of course, infinite energy would bring about infinite destruction, bombing not just a handful of stars, but everything in the entire Universe.

Gladly, no present-day scientist is capable of mining the quantum vacuum. On the other hand: one day, there will be. And that day may arrive sooner than you think: some estimate around 2020 science will be ready. Let's hope physicists finally have their calculations straightened out by then.

So it's `wait and see'. And talking about `seeing': as the famous science-fiction writer Arthur C. Clarke once pointed out, whenever you see an unexplained burst of energy coming from the cosmos (and there are a lot of them), it may be some alien civilization, blowing itself to kingdom come while experimenting with the quantum vacuum...

STRANGELETS – any day now



Isn't that appalling? This morning, all matter on our planet suddenly changed into a very different kind of stuff. The changes are quite radical. For one thing, our bodies have just ceased to exist.

This time, the trouble didn't come from some colossal piece of rock slamming into our planet, or from some divinity deciding to end our world. No, the danger was so small we didn't even see it coming. We're talking **quarks** here: the tiny building blocks that make up protons and neutrons.

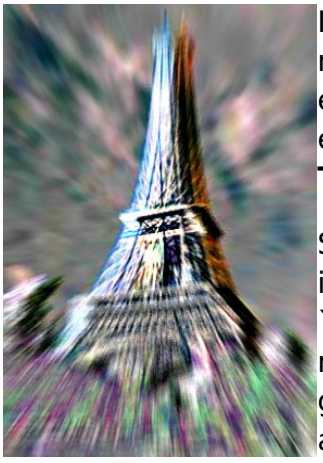
Quarks come in different `flavors'. There's `up' quarks, and `down' quarks, and `strange' quarks. The nuclei of atoms are made of just the right mix of just the right quarks. Matter ultimately is made of `up' and `down' quarks.

But other mixtures are possible too. In the first moments after the Big Bang, there also was stuff made of `up', `down' and `strange' quarks. It was a completely different kind of stuff than what we're used to. Appropriately, scientists call it **strange matter**.

But as the universe expanded, strange matter vanished -- although some chunks of strange matter (called `S-curves') may still be out there somewhere. One thing's for sure, though: no human has ever actually spotted a single speck of strange matter.

Oh, but that can change. In recent years, quantum physicists have tried hard to imitate the earliest moments of the Universe. That sounds more difficult than it is: the only thing you have to do, basically, is to slam two particles at tremendous speed head-on into each other. And that's exactly what they do at huge particle accelerators such as those at CERN in Geneva or the `Relativistic Heavy Ion Collider' (RHIC) at Brookhaven National Laboratory in New York.

You already feel what showed up this morning. Strange matter, my friend. LOTS of it.



In a particle accelerator experiment, a tiny bit of strange matter suddenly popped into existence. Against all expectation, it had a negative charge. The next moment, it engaged into a chain reaction theoretical physicists call `**Ice-9 Type Transition**'.

Sure, the lump of strange matter that showed up was incredibly small. But that changed within moments, as the `strangelet' began gobbling up all positively charged atomic nuclei it encountered, forming more strange matter. The blob grew and grew, eating the accelerator, the building around it, and the town around the building. It turned everything it encountered into more atom-eating strange matter. It was ice-9 at its best. Within seconds, our entire planet including everything on it became a strange matter planet.

Does that, er... **matter**? Oh man, you just don't wanna know. All conventional atoms ceased to exist this morning. And in case you forgot, everything we know of,

including us, is made of atoms. What's worse, strange matter particles are equally charged, making them want to go away from each other as far as possible, like the equally charged sides of a magnet. Simply put, all matter on the planet has fallen apart this morning. The world went boom, or whatever the sound was.

Well alright, I'll admit it. Of course, nothing really happened today. I wouldn't be writing this if it had. But could it happen tomorrow? Or next week, next year?

Here's some reassurance: strange matter is so unstable, it simply wouldn't have time to consume nearby atoms. What's more, strange matter probably has a positive charge. And positively charged strangelets aren't very dangerous. They would have an appetite for electrons, sure, but this wouldn't bring about a chain reaction. The strangelet would simply snatch away a few electrons from surrounding atoms, and that would be it.

Would, probably, perhaps. Actually, no one knows for sure. As I already mentioned, no human being has ever studied a chunk of strangeness. And if scientific history has made one thing clear, it should be that reality often defies theory. As the Russian theorist Lev Landau once put it: `Cosmologists are often wrong, but never in doubt.'

Strange, don't you think?

BLACK HOLES – AD 2007

No, really -- you just don't want to know this. There's a remote, but extremely terrifying possibility our planet is about to be swallowed from within by a man-made black hole. In fact, our planet could be booby trapped with baby black holes already.

It is one weird way to go. One moment, you're here. And the next -- you're not. It will be sudden, and dramatic. Within seconds, the planet, with everything and

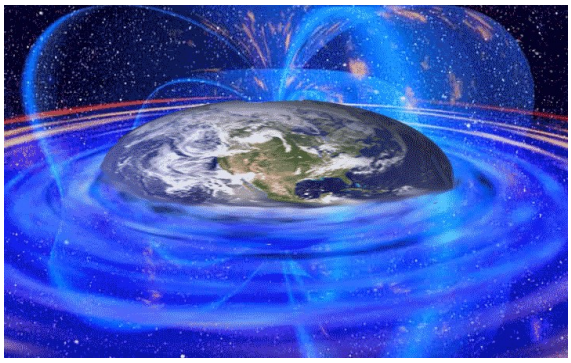
everyone on it, is reduced to nothingness. Or actually: it is squeezed together into a tiny black hole, no more than 9 millimeters wide.

If you were to play back the tape of what went wrong very slowly, you would see something very peculiar. Suddenly, you would see the Earth deform. Obviously, not a very good sign. Our planet is flattened out to become a disk.
Beams of radiation shoot up from where the poles used to be. And then, zzzp, the planet's gone. Just like that. Within a split second, it would simply vanish, right before your eyes.

Understandably, on board the International Space Station, this will cause some confusion, to say the very least. Astronauts will be stunned to find that their space ship suddenly no longer orbits a planet -- but, well, nothing much really. The only thing that is out there, is a tiny black spot, invisible to the eye. Still, the speck has the same mass as the Earth. For the time being, the Space Station will remain in orbit, just like the Moon and the satellites. A very silly thing to see, of course.

Perhaps some astronauts will realize what has happened. They might recall how back in the early 21st century, physicists tried to create baby black holes in the lab. And now, many years later... Well, the black holes obviously did show up, after all.

Let's build a hole: The science of DIY black holes



There goes the Earth...

Luckily, the chances of the disaster outlined above really happening should be vanishingly small. But: some risk is there all the same.

First, you should know that in principle, making a black hole is easy. Basically, the only thing you need to do is to slam two tiny, subatomic particles together in a particle accelerator. If you use enough force, the collision should yield a tiny black hole. (To find out what a black hole is, read our section on black holes from space).

Until recently, most scientists believed creating baby black holes couldn't be done on our planet. You would need a particle accelerator as big as the solar system, most scientists assumed. But nowadays, that's all changed. Quite a lot of physicists think a much smaller particle accelerator can do the trick, too. Such as the 'Large Hadron Collider' (LHC), a particle smasher to be opened in Switserland in 2007.

Luckily, a man-made black hole won't be a roaring monster that gobbles up planets and stars. Rather, science expects an incredibly tiny baby black hole, much smaller than an atom. What's more, it should evaporate immediately. Black holes give off

radiation. And our black hole would be so incredibly small and hot, it would radiate itself away in less than 0,000000000000000000000000001 seconds! That's why physicists feel pretty confident about working with the LHC. No problem if a black hole shows up. According to the laws of physics, black holes from the lab just shouldn't be stable.

BUT. There is always a small possibility that the predictions are wrong. Particle accelerators are there to break new ground -- to explore new physics. And the physics science is about to explore, is really new and exotic. Nobody has ever seen a mini black hole. In fact, no one has even the faintest idea how gravity works on very small objects.

So, it's 2007, and science switches on its LHC. According to some calculations, this super particle accelerator could summon up one black hole every second! There they are: black hole, black hole, black hole; Pop! Pop! Pop! Now suppose that against all expectations, these baby black holes aren't the fleeting, unstable mini monsters we expect them to be. Suppose they're stable.

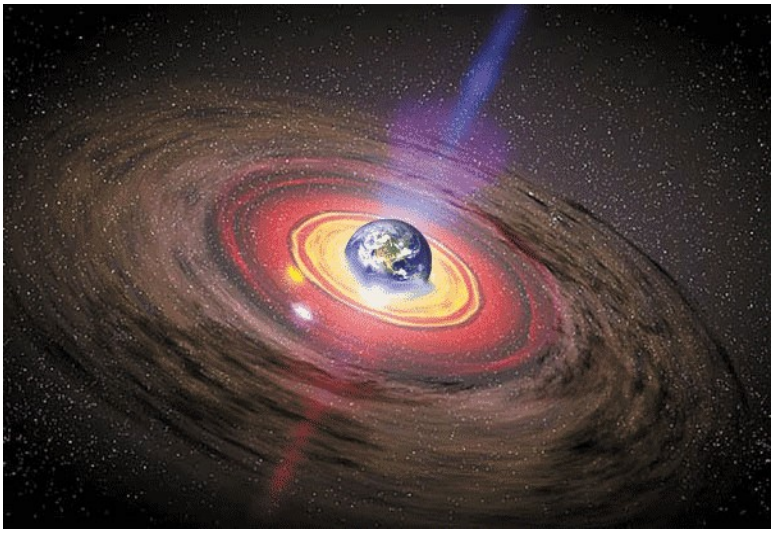
At first, no one would notice. They wouldn't eat up the lab or something. Instead, they would escape. One by one, the baby black holes would leak away from the lab, going through concrete walls as if they didn't exist. If you're that small, traveling through solid objects is no problem: you just rarely bump into a molecule.

And then? Slowly, our refugee black holes would begin to sink towards the center of the Earth, attracted by gravity. And there, they would sit and wait.

But sooner or later, a hole will indeed bump into an obstacle. An electron, or an atom's nucleus -- tiny stuff like that. The black hole will swallow whatever it encounters. This will make it heavier. It will have more gravity, and pull in some more particles. It will get heavier still. And suck in more and more matter.

Eventually, the black holes will merge. They will suck up the Earth's core, the mantle, and finally -- the entire planet.

Gladly, it could take a baby black hole thousands, if not hundreds of thousands of years to mature. That should give us some time to learn more about them. But the bad news is that even in the distant future, there isn't much we can do. You cannot find or catch a black hole that is so small you cannot even see it, and that hides deep within the molten iron core of the planet. The only option is to evacuate the planet, if we happen to discover the predictions were wrong.



So, should we leave?

Well, that’s hard to say. As far as we know, everything should be okay. Our world is constantly being bombarded by tiny, high energy particles from outer space. This should also create mini black holes, high up in the atmosphere: up to one hundred each year. And as far as we know, these black holes are indeed unstable. For the last 4,5 billion of years, our planet didn’t die.

On the other hand: in physics, quite often, a totally unexpected, new phenomenon pops up. In recent years, physicists lifted their eyebrows over dark energy, the Pioneer anomaly, the missing of the Higgs boson, the pentaquark and the suspected drift of the fundamental constants. No, we're not going to explain all that -- but the bottom line is this: physicists are constantly being surprised by weird new stuff that wasn't in the theories yet.

Now, you don't want to be such a surprise to be a black hole that has our planet for breakfast!

And then there’s this. In march 2005, scientists working on the Relativistic Heavy Ion Collider in Upton, New York created a fireball that indeed looked awfully much much like a black hole.

It was unstable. In fact, it wasn't even a real black hole. Or so the scientists involved say. Perhaps the first man-made black hole is on its way to the center of the planet already!

LINKS OUT:

Black hole production at LHC

"Black hole-like phenomenon created by collider". In: New Scientist, 19 March 2005

Valerie Jamieson: "Black holes, but not as we know them". In: New Scientist, 22 January 2005

John G. Kramer: "CERN's LHC: A black hole factory?"

PAPER LINKS:

Ernst van Eijk: "Zwarte gaten uit het lab". In: Natuurwetenschap en Techniek, Maart 2005

Bernard J. Carr and Steven B. Giddings: "Quantum black holes". In: Scientific American, May 2005

[RELIGION]

APOCALYPSE

Millions have prayed, sacrificed, repented, flogged their backs, pilgrimaged, even killed themselves -- all because of the particularly nasty scenario of doom and destruction laid down in the Bible book `The Apocalypse'. However, most modern Bible experts agree that St. John never meant the end of the world to be taken too literally.

Okay, so here's what's gonna happen. According to John's visions, it all starts to go wrong when the `lamb of God' one day decides to open up the huge, sealed book of life. The looks of the lamb betray little good. As John writes, it looks `as it it were slain, having seven horns and seven eyes.'

Don't worry, we mortals probably won't have to face this heavenly lamb -- yet. The first thing we do notice, is four horsemen: one on a white horse, one red, one black and one pale. The band of horsemen is here to bring about a
lot of misery. The swordsman on the red horse spreads war, the man on the black horse leaves a trail of famine, and that skinny guy sitting on the pale horse, that's

Death himself, bringing `plagues or pestilence' -- John leaves it up to Mr. Death to decide. By the way, the guy with the crown and the bow on horse #4 causes no problems in particular.

The horsemen are barely there, and here comes more trouble. Suddenly, the Sun goes black. The Moon becomes red as blood. There's a massive earthquake. Amazingly, the stars drop from the sky like figs from a tree, and the heaven slams shut `as a book folded up'. All mountains are dislocated, and every island begins to drift.

Still surviving, right? Wait, the worst is yet to come. Suddenly, everything becomes quiet, and in the `four corners of the world' (sic), four angels appear. It's the angels that cause the silence: they hold back all wind. Then, from the direction of the Sun, a fifth angel descends, carrying a special item John calls `the seal of God'. The angel marks the slim total of 140.000 Jewish people with the seal, and rushes home. By now, you're probably beginning to feel somewhat nervous. John anyway foresaw that a huge crowd would dress in white robes and pray for salvation.

And to be honest, nothing has really happened yet. After half an hour of complete silence, all hell breaks loose. There's a huge thunderstorm, there's the sound of voices coming out of nowhere, and there's another massive earthquake. Next, there's hail. And fire, burning up all grass and pulverizing one third of all trees. A mountain-sized comet plunges into the sea, turning one third of all water into blood while killing a third of all organisms living in the sea, and sinking one third of all ships.

It becomes darker still. A talking eagle is spotted. It screeches there's more to come. And that's no understatement. For the next moment, another meteor plummets into the Earth. An angel brings out a key and uses it to open the lid of a bottomless pit humanity somehow overlooked. Now, you're in for some REAL trouble.

There's smoke coming from the pit, and then, suddenly, huge amounts of killer locusts, each as lethal as a scorpion, flock out of the smoke. The scorpion locusts leave the 140.000 who carry the divine sign unscathed, but sting everyone else, for five long months in a row. By now, people `shall desire to die,' John estimates. But isn't that a pity: to their astonishment, they discover it is no longer possible to die.

Then, after those five painful months, the locusts take the shape of horses, albeit with manlike faces, long hair and lion's fangs. They total the number of two hundred

million. The king of the monsters, a guy appropriately named `Exterminans', arrives at the scene.

Still holding out? Prepare yourself, actually they've been treating you mildly so far. Suddenly, the locust army out of hell sets out for a huge massacre, butchering one third of all people. People are burnt, suffocated in smoke, or squashed by huge lumps of brimstone, all of which sling out of the locust's mouths. Cities crumble, Jerusalem is destroyed and there's another earthquake, a devastating thunderstorm, and yet another earthquake.

Then, a sign is spotted in the sky. It's the Virgin Mary, `clothed with the Sun, and the Moon under her feet, and on her head the crown of twelve stars', as John puts it. Another sign is seen: a huge, red dragon that uses its tail to throw one third of all stars (weren't they already gone?) to the surface of our pitiful planet. In a brief but fierce fight, the dragon along with several other demons is booted out of the sky. Unfortunately, they all fall down to earth. The dragon is in a bad mood. It declares war on the Virgin Mary and her likes.

And when that happens, you'd better hide. Out of the sea rises a huge beast, with seven heads and ten horns. (In a later chapter, John will explain that the ten horns are actually ten power-hungry kings without a kingdom.) The beast has `words of blasphemy' written on its seven foreheads, has the feet of a bear and the mouth of a lion. Don't try to kill it, you'll find that the head you're hacking off grows back on within moments.

If you can't beat 'em, join 'em, most people decide. They kneel in front of the beast, and decide to `adore' the dragon. The sea monster reigns for 42 months, speaking the curious combination of `great things and blasphemies'.

Then a second beast hits the scene, this time coming out of the earth and wearing two horns. The new beast takes over power from the sea monster, and demonstrates his supernatural talents, for one thing by letting it rain fire on earth. Understandably, the remnant of the earth's inhabitants accept the beast willingly as their new leader. They should have known better, though: the number of this beast happens to be 666. Although John never actually calls it that way, the beast is in our time often referred to as the antichrist.

Meanwhile, the 144.000 who still carry the mark of God on their foreheads decide they don't want to have anything to do with the beasts. On mount Sion, they team up with the divine lamb. Also joining are three angels, one of which sets out to warn the masses not to hang around with beast nr. 666 anymore. Meanwhile, another angel reassures the 144.000 that the sinful city of Babylon will soon be destroyed. In yet another supernatural appearing, someone looking much like Christ descends on a cloud. Next, seven more angels appear, carrying seven divine plagues. Still following?

Now, if you're one of those who take the antichrist beast for leader, you're definitely in for trouble. The first angel strikes and wounds everyone. The second one turns the sea into blood, whereupon `every living soul' that happens to be in the sea drowns. The third angel turns all rivers and fountains on Earth into blood. The fourth angel harasses the population with heat and fire. The fifth angel brings darkness to the beast's kingdom. The sixth angel heads for the Middle East and dries up the river of Euphrates.

The unholy threesome -- the devil dragon, the antichrist and his false prophet, who is also there -- take up the glove, and declare an all-out war on God. They send out three ghostly frogs to convince all world's leaders to engage in the final battle. God in the meantime gathers his troops at a place which in Hebrew is called Armageddon (literally: the hill of robbers). And there's more voices and thunderstorms. Not to mention the biggest earthquake that ever shook the Earth, all previous apocalyptic earthquakes included. More cities crumble. Mountains collapse. Every island is swept from the face of the earth. And there's more hail, with hail stones as big as tennis balls.

Another angel descends, declaring the evil city of Babylon has just been destroyed, it only took one hour. Kings and merchants lament over the devastated city. A bright, avenging angel descends to lead the troops of God: it sits on a white horse, wears a blood sprinkled garment and has the dubious pleasure of carrying a two-edged sword in its mouth. Together with the others, the angel beats the antichrist and his false prophet and throws them into a pool of lava. If you were dumb enough to have joined the antichrist, you're dead: the angel with the sword slashes everyone and uses the corpses to feed the birds.

Now that the big part of the job is done, it's time to clean up the mess. Another angel comes down, ties the defeated devil dragon, tosses it back into the pit and shuts the lid. Not to be opened for another thousand years. Every martyr Christian that was ever beheaded comes back to life. Reunited, they live and reign for a thousand years.

But time flies when you're having fun. Suddenly, it's a thousand years later, and oh boy, the devil is at it again. He comes out of his pit and seduces all nations to join him in yet another war against the city of martyrs. But God himself puts the uprising swiftly to an end, by letting out a huge heavenly fire, which burns all the bad guys. This time, the devil himself is tossed into the pool of lava. The false prophet -- obviously, he survived the lava the first time -- is taken captive. He will be tortured forever, John is told.

Now, it's time for the final judgment. All the dead rise, and are judged `according to their works'. Many are cast into the pool of lava, those who have an entry in the book of life -- the chosen ones -- live forever.

By now, our planet has underwent some radical changes.There are no more seas, for instance. The skies open up, and an entire city -- the new Jerusalem -- gently lands on earth. It is made of gold, has twelve foundations, twelve gates and twelve angels guarding the gates. People don't die anymore. And what's more, they don't suffer, cry or worry about anything anymore. There are no more murderers, sorcerers, liars and, notably, no more dogs. Also, there's no more day and night. The world bathes in the gloom of the glory of the Lord. `Behold, I make all things new,' God declares.

No, seriously: should we worry?

All in all, the end of the world John foresaw is quite a ride. Interestingly, it lacks a well-defined chronology: the stars are swept from the sky again and again, the antichrist and his prophet die and come to life, people are killed in vast numbers, but in a next chapter, they seem to be doing just fine. According to theologists, this timelessness depicts the heavenly point of view of eternity.

But the lack of a clear chronology also makes the book prone to speculation: what apocalyptic state are we in today? Didn't we already have the diseases, hunger and war? And hold it, that Saddam Hussein guy, isn't he the antichrist?

Arguing like this, people have seen the antichrist in Napoleon, Stalin or Hitler, while others have connected the emerging beasts with the US and the USSR, the German empire vs. the Allies, Saddam Hussein's Iraq vs. the UN, or Milosevich's Serbia vs. NATO. But let's assume John's vision is to be taken literally. Clearly, we would have noticed an earthquake that dislocates all mountains and islands on earth, an army of demon-like locusts attacking us and two comets that slam into our inhabited world -- to mention only a few.

Still, even today many Christians believe the world will end sooner or later, with or without all the monsters, earthquakes and supernatural battles involved. Mainly, this is because the the book is very abstract and obscure to an untrained reader.

The Apocalypse is by far the most difficult, hard to understand Bible book of them all.

Bible scholars have pointed out that John wrote about the vision around 70 A.D., a time when Christianity was brutally being persecuted and actually in danger of becoming extinct for the first time. John, himself being captured and thrown into a pot of boiling water once, wanted to support his fellow believers. The Apocalypse was his way of saying: don't despair, we will win in the end.

Interestingly, the imagery from The Apocalypse is deeply imbedded in the religious traditions of John's time. As many scholars have argued, almost all beasts, eagles, locusts, dragons and acts of nature John describes stem from the long standing tradition of Jewish religious culture -- and even date back to the Zoroastrianist apocalyptic of the ancient Iranians. The symbol language John uses would clearly have been understood by the faithful from John's days.

So, should we really worry about antichrists and demons waging war on God? You guessed it: probably not. Well, don't be disappointed, there's plenty of other, more realistic apocalyptic scenario's left!

Once, I visited a personal homepage where a movie fan brilliantly parodied all apocalyptic soothsaying. The guy that ran the page argued that television actor David Hasselhoff is in fact the devil. Among many other things, Hasselhoff definitely is the monster that comes out of the sea: he does it all the time in the *Baywatch* series. You may take the seven heads that keep growing back on for the seven TV-series he's in and that are constantly rerunning on television. And so on, and so on.

Clearly, the guy has a point. Translating abstract biblical vision into secular fact is a risky, haphazardous business. It can only lead to disconcern and more, hilarious speculations.

HINDUISM

Forget about nuclear weapons, forget about tanks. One guy riding a horse may be all it takes to kill everyone on the planet. Kalki, is the soldier's name. And his only weapon is his sword of holy vengeance.

There he is. Riding a pale white horse he suddenly makes his appearance on the beach, blandly rising out of the sea. The horseman looks
quite kind, really. Well, after all he's only here to restore good on Earth.

But to restore good, evil has got to pay. Suddenly, the man on the horse draws a sword. And off he goes, `fast like a comet'. Zoom!

Everywhere he rides, he brings about death and destruction. Did you `dress like a king'? Chop, there goes your head. Did you `commit sin in mind, speech and actions'? Slash, you're dead. Did you lie, did you eat the meat of a cow, were you a member of a sect? Stab, you're history.

It's a little while later, and the swordsman takes a break and looks back on a hard day's work. The earth is soaked in blood. Billions have died. Only a few truly good men have survived the ordeal.

But the guy on the white horse isn't done yet. He takes out some kind of supernatural lighter, and sets the place on fire. Crops burn, cities smolder. Within moments, the entire planet is on fire. And it goes well beyond that. The planets, the stars, yes, the entire Universe burns up.

Well, the man who brings it about isn't an average guy. An avenger from heaven he is; the tenth and final incarnation of Vishnu, Hindu god for all matters concerning creation and destruction. Kalki, is the incarnation's name. And he has come by to make the Universe a better place.

So he does. Once our reality is burnt to shingles, Kalki simply creates a new one. The Universe is reborn, the stars are reborn, and yes, the Earth is reborn too. A new, purified mankind reincarnates on the New Earth. People will be awakened, and `pellucid as crystal'. Kalki has led the cosmos into a new, everlasting state of being: the Age of Purity.

Now don't say you didn't see it coming. The signs that something was about to happen were jotted down many centuries ago in ancient Hindu writings,
the **Puranas**. According to the Puranas, we currently live in the **Age of Kali**: a dark, evil cycle of time in which humanity and religion are corrupted and degraded. And Kalki is here to put an end to these evil days.

The omens outlined in the Puranas indeed look familiar. In the Kali Age, the Puranas say, world leaders will be liars, people will be full of anger and without religion, simple men will be rulers, and men will live according to the customs of others. There will be many sects and many `experts' claiming to know everything. The planet will be valued only as a resource for minerals. Money and expensive clothes will be all-important. People will marry solely for pleasure. The world will be

governed by `powerful men with severe faults' who oppress the poor and support the wealthy.

As the coming of Kalki draws near, there will be even more of this. Also, there will be numerous famines, droughts, diseases, wars and other calamities. `People become poorer in vigor and luster. They are wicked, full of anger, sinful, false and avaricious,' the Puranas foresee.

So it's about time Kalki and his swift sword went on judgment tour, right? Oh, come on. Get serious. You don't REALLY believe we are about to be chopped up by this Kalki guy, do you?

For example: another apocalyptic `omen' outlined in the Puranas states that men living at the end of the Kali Age don't get older than 23 and that the poor will dress in clothes made out of tree bark and leaves. And this is definitely not happening -- or at least, not yet.

Kalki, the guy who likes the elite

Like all apocalyptic writings in religion, the Kalki episode of Hinduism is there for a very down to earth, social-historic reason. Actually, it has to do with power. The Kalki myth is seen as a means to maintain the Hindu caste system, and the rule of the supreme Brahmin caste in particular. That's why the Puranas state over and over again that in the `evil age' of Kali many ordinary people become rulers -- and how wicked that is.

The Hindu apocalyptic clearly is a pro-Brahmin chunk of religion: Kalki, himself a Brahmin, will slash every non-Brahmin who dared to become a ruler with top priority. As one scholar summarized the story: `Kalki is about to come to cleanse the world of those who are not the slaves of Brahmins.'

So think of Kalki as, well, the Boogie Man of Hinduism. If you disobey the rules of the Hindu social order, chop-chop -- you're dead.

Still, the Kalki scenario has deeply influenced a lot of faithful believers. The Baha'i faith for example claims its founding father Baha'u'llah is actually Kalki -- although Baha'u'llah clearly never went on Vengeance Tour and certainly didn't set the Universe on fire.

Likewise, the Sai Baba movement holds Sai Baba for Kalki. The `Foundation for World Awakening' claims Kalki is alive and kicking somewhere in South India. The Bagwan Movement has found its Kalki in their leader Vijayakumar. And still others believe the preacher Sri Padmavathi Devi in fact is Kalki. No doubt the real Kalki would know how to take care of such semi-saviors and their followers.

In recent days, there have been at least three big `Kalki scares' among Hindus. In 1962, the alignment of the eight visible planets of the solar system was taken for a heavenly token, marking the coming of Kalki. Well, it wasn't.

In 1984, Hindus held their breath again, because the Puranas seemed to suggest 1984 was Kalki time. And in 2000, Christian millennium fears spread to India, as many devoted Hindus prayed for Kalki to please pass their doors. And so he did, he didn't show up.

What `Kalki day' will be up next? No one knows. As good predictions do, the Puranas are exceedingly vague about the date Kalki is due to arrive. It will happen `when corruption is beyond every measure of control, necessitating the end of the world.' So that could be any time, really. Better keep your suit of armor on for a while.

ISLAM

Over the last few days, we've had earthquakes, and wars, and many freakish natural phenomena. But that's nothing, really. When you hear a trumpet sound, better say goodbye. Allah is about to wrap up the Universe he created.

Oh, that good old Koran story about the end of days! The end of times as outlined in Muslim writings is one of the very finest religious apocalyptic scenario's around: rich in detail, vivid, and far reaching in religious implications. No wonder so many Muslims are deeply convinced judgment day (`Qiyamah', in Koran terminology) will come about one day.

So here's what will happen. The Koran discernes `minor' and `major' omens predicting the end of days. Many of the `minor' omens (there are 72 signs in total) are already here for everybody to be seen. Men will behave more like women and women will imitate men. Men will dress in silk. Children will be disobeyant, and youngsters will be role-models. People who used to be shepherds will build tall buildings.

And there's more. Many will engage in dangerous sports, divorces will be a daily occurrence and people will favour their friends over their families. Liquor will be

consumed in the streets, and dancing and wild music will be everywhere. Religious leaders will make worldly profits, while intellectuals rather engage in science than in the study of religion. Also, there will be the usual apocalyptic rumble-a-bumble: earthquakes, devastating wars, storms and floods. If you add things up, it looks like the end of days is quite near, don't you think?

Well, don't worry -- yet. When time's up, you can't miss it. For the signs will become more and more grotesque. One after another, they roll in like `a string of beads falling one after the other', as the prophet Muhammad put it.

As a first sign the countdown to doomsday is ending, nature displays some very odd phenomena. You'll notice red winds sweeping across the country. Some people find their face gets malformed -- hey, isn't that a pig's face? Others are even less fortunate: everywhere, people are suddenly swallowed into the ground.

Then a cataclysmic religious war breaks out. It's Muslims versus Christians, and soon after the outbreak of war, half of the Christian armies sign a peace treaty with the Muslims. The Muslim-Christian coalition conquers Istanbul, while the `bad' Christians conquer Syria. But that all changes when the Christian army starts heading for Mecca. Suddenly, the ground cracks open and gone are the Christians.

Well, that doesn't mean war is over. The Muslims raid the Middle East, lose two thirds of their army but in the end win back Syria and Palestine. Immediately, they declare Holy War (Jihad) on India -- and win.

You find all this warfare a bit boring? Just wait, more miraculous things are about to happen. As peace settles down in the Muslim empire (that by now stretches from the Middle East deeply into Asia), the world is plagued by a severe drought that lasts three years.

After that, suddenly a very creepy character shows up. Al-Dajjal is his name. And he actually is the Muslim anti-Christ. Well-educated Muslims will instantly recognise the guy: he is short, red-faced, has hair that sticks up and is blind at the right eye. The false prophet inspires vast amounts of followers anyhow: 70,000 heavily armed believers join the bad guy.

Gladly, in the meantime another chap comes to power: Al-Mahdi. Now Al-Mahdi is there to keep the balance between good and bad. He is a military leader, is named after the prophet and of course calls everyone to the true Islam as often as he can.

It takes a third miracle man to break down the stalemate between Al-Dajjal and Al-Mahdi: Jesus. Yes, you read that right: when the world is about to end, Muslims too

expect Jesus -- `Isa' in the Koran -- to return from heaven. It is a miraculous thing to see, since Isa returns with much dramatic display: he descends from the sky in Damascus while a mass prayer is going on. If you're a Christian, you're in for a big surprise: without an eye's blink, Jesus denounces Christianity and calls upon everybody to convert to Islam.

And Jesus is in a fighting mood. He turns out an excellent military leader, as he goes out to pick a fight with Al-Dajjal. While more and more people convert to Islam, Isa defeats the false prophet. Jesus kills Al-Dajjal himself. It happens in the valley of `Ifiq', near an Israeli airport.

After that, a brief period of peace sets in. Jihad stops, Islam rules, there's peace and prosperity everywhere and Isa himself retires, marries, has many children, dies after nineteen years and is buried next to Muhammad.

But wait, it was still merely the beginning, a kind of warming-up for Allah. For the next moment, the real stuff begins. Prepare for the end of days!

In four countries, the ground suddenly caves in, leaving four enormous, gaping pits in the Earth's crust. Next, there's fog. For forty days, thick layers of smoke blanket the sky. If you were still a non-Muslim, you pass out. Muslims develop terrible colds.

Finally, the fog lifts up. You might expect to finally see the sun again. But to your amazement, it is completely dark. For three days and three nights, the Sun simply is not there. No wonder people all over the world start feeling a bit `restless' by now, as the Koran puts it.

Then, the Sun finally rises again. But wait, what's that? The Sun rises in the West, crossing the sky the wrong way around. By now, if you are still a non-believer, you might want to convert to Islam. But isn't that a pity: after the Sun-rising-in-the-West-incident, Allah won't listen to any more repentence.

It's one day later, and here comes the next miracle already.Near Mecca, the ground starts to rumble, and the next moment, a giant beast lifts itself up out of the ground. Astonishingly, the beast can talk. It raises its claws, and look: the faces of the faithful begin to glitter, while the faces of the non-believers darken.

Not that a glowing face really helps you that much. The next moment, a breeze from the south comes in. It causes sores in the armpits of all Muslims. They suffer terribly and die. Only the non-believers remain. If you're one of them, you'll probably feel a bit nervous. It is perfectly clear that you have to witness the end of the world.

Allah indeed seems to have abandoned the world. Back in Mecca, the Kashba is destroyed by a troop of African invaders. The Koran is suddenly completely forgotten. In Yemen, a huge fire breaks out. If you are by chance a Yemenite and

still surviving, you run for your life. But the fire follows you, all way to Syria. There the fire suddenly stops.

You wait for more to come. But nothing really happens. The silence lasts hours, then days, then months. Though you're bewildered and scared, you try to settle down, attempting to start a new life on your damned planet. You've had wars, monsters, fires and darkness, so how much worse can it really get?, you ask yourself retorically.

Well, it can. After several years of tranquility, a eery and ominous sound echoes over the world. Although there are no Muslims left, some people might recognize it for what it is: the sound of the angel Israfil, blowing the doomsday trumpet of Allah. It's the last thing you'll ever hear. For the next moment, the entire universe with everyone in it simply ceases to exist. Zzzip, gone.

Before you know what's happening, you find you're facing the big man himself. Allah is there, right in front of you. He is surrounded by angels and clouds.

Suddenly, you have a tremendous flashback on your life. You understand the consequences of everything you ever did. `Whoever has done an atom's weight of good will see it, and whoever has done an atom's weight of evil will also see it,' the Koran explains.

It's judgment time. If there's too many grains of evil, off you go to hell. Or was there more good in your life? Then lucky you, you get to spend the rest of all eternity in the heavens of Allah, where everything looks about the same as on Earth -- but much, much better.

MAYA – 12/10/2012

Will it be the end of everything? Or will it be the dawning of the age of Aquarius? No one really knows. One thing's for sure, though. December 21st of the year 2012 is the day time as we know it will end.

So at least claim the Maya's, that ancient civilization that lived in the Mesoamerica's since 2,600 BC. The Maya's had an extremely complicated method of keeping track of time, based on three separate calendars. The most important, most encompassing of these calendars holds the `Long Count': the period from the beginning until the end of time. And on December 21st 2012, the Long Count expires. It will be point zero. Time will be up for the Universe. It will be, literally, the end of days.

Big deal, you might say. Still, there's a couple of very interesting (and disturbing) facts about the Maya calendar's end. Most intriguing, 21-12-2012 is not a day like any other. Up in the sky, an extraordinary and incredibly rare event will take place. The Sun will move to a unique spot in the sky -- and hold still for a while, since it is solstice day. The Sun will sit precisely on the heavenly crossroads between the Milky Way and the galactic equinox, forming a perfect alignment with the center of the galaxy.

Er... what?

Well: the night time sky is crossed by several mathematical lines. One is the axis of the Milky Way -- the Milky Way, as you may know, being that bright band of stars you can see running across the heavens on a clear night. Another important line is the cosmological ecliptic: the axis along which the constellations travel, the line that defines coordinates in space.

You can say a lot about the Maya, but you've got to hand it to them: they knew a hell of a lot about stars. For instance, they calculated the exact duration of a year to a thousandth of a decimal point, much more precise than any Greek or enlightened philosopher ever did. Also, they were able to predict every solar and lunar eclipse until this day. And obviously, they knew where the galactic equinox and the exact middle of the Milky Way lay: they called this crossing `the Sacred Tree'.

More disturbing, the Maya's were awfully good at astrology, too. Mysteriously, they predicted in what year their civilization would be overrun by foreigners coming from over the seas. Legend has it they even predicted the world wars. So if a Maya tells you the world will end in 2012, you'd better take it seriously.

But actually, the Maya's never predicted anything concrete about 2012. That may have something to do with our ill knowledge about Maya culture: when the Spanish ransacked the land, they burnt literally every Maya book they could find. Only a handful of scriptures survived. And in them, there's not a clue about what happens when the Maya calendar ends.

So what awaits us in 2012 basically is an open question. And as with so many open questions, countless doom preachers, semi-prophets and other crackpots pop up to provide an answer. The interpretation you hear most: 2012 will mark the coming of a new, glorious age of wisdom and peace. It will be Age Of Aquarius at last, with a world full of peace, love and understanding.

The reasoning behind this is actually not that stupid. The Maya's didn't really believed in endings: their conception of time was circular, with every end being the beginning of something new. So, 2012 shouldn't be an exception.

Also, the Maya's had a highly developed philosophy of the cosmos. They saw the cosmos as the true mother of things. Consequently, the Maya's thought the cosmos is all around us, and within us. Every plant, every animal, every man is sheer Cosmos.

So, New Age philosophers say, December 21st 2012 will be the day on which this inner cosmos is reconnected to the divine outer cosmos. The Sun will mount its unique position to form a `gateway' between the Universe and the souls of every living creature on Earth. Our linear conception of time will crumble, and with it, fear and hatred will vanish. It will be purification at it's very best, when everyone is soaked in cosmic understanding and divine love.

So there it is: on December 20th, you'll kick your dog, yell at your spouse and cheat on cards. But a day later, you'll be calmed down into a peaceful dude with nothing but love and understanding to guide you in life. Even though it's mid-winter, it'll be summer of love for all humanity.

Other doomsayers foresee doom and destruction. December 21st will be the day the Earth will be destroyed. Some think it will be because of some nuclear war, some say it will be because it's biblical judgment day. Even others take the ending of the Maya calendar more literally, and claim the Universe will just cease to exist. Zzzzp!, gone.

There's something to be said in favor of such sinister scenario's, too. The Maya divided their Long Count into five lumps of time, called Great Cycles. And every cycle had a well defined end. For example, after period number one, a Jaguar came by and ate everyone on Earth. Well, it's the Maya saying this, not me!

The second cycle ended in air, the third in fire, the fourth in flood. And what about the last period, the stretch of time we're in? The Earth will be destroyed by

earthquakes, is the interpretation some scholars give to the etchy-sketchy remains of the Maya culture. That needs emphasizing, because the last word on Maya timekeeping isn't said yet: almost every year new books on the issue are published.

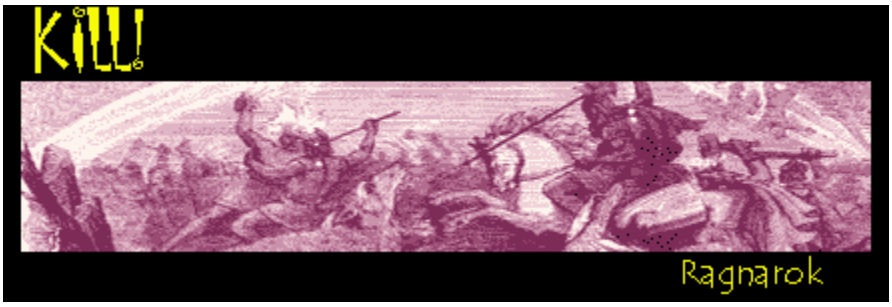
So, what are we to make of it all? Will it be time's up in 2012? Well: we at Exit Mundi wouldn't bet on it.

Don't forget: there are many, many religions predicting some kind of end to the world. And the Maya prediction attracts a lot of attention now, merely because their end date is so well-defined, and because the Maya Deadline is only a couple of time-ticks away.

And what about that awesome phenomenon of the Sun sitting in the heart of the Tree of Life? Well, that happened before. The Sun passes the Tree every 25,800 years. That's a lot of years, but since the Earth exists for an astonishing 4,5 billion years, the Earth survived the `divine event' more than 150,000 times already!

What's more, the last six times the phenomenon occurred, modern humans already walked the planet. Obviously, it didn't have much effect on our spiritual lives. It certainly didn't stop the Spanish from butchering some 800,000 Maya's in the sixteenth century.

RAGNAROK



If you think you've seen it all, just wait for Ragnarok, the end of times foreseen by the ancient Vikings. In it, the world turns into a vast, smoking battlefield. Featuring

a wolf with a mouth as big as the sky, a giant with a burning sword and... a kind tree.

If only the Vikings knew. Today, hundreds of years after the Vikings roamed the coasts of northern Europe, the Nordish word ‘Ragnarok’ gives you more than two million hits on Google. ‘Ragnarok’ is a word from Tolkien. It is a computer game. A card game. A rock band. An opera. And much, much more.

But who knows, one of these days, the REAL Ragnarok might unfold. Ragnarok means ‘fate of the gods’. It is the Viking version of the Apocalypse. Believe us: you don’t want to be around when it happens.

It all starts with a winter that just won’t stop.For three years in a row, summer doesn’t come. All there is, is this harsh, terrible winter. It is freezing cold, so you stay indoors, and get bad-tempered. As a consequence, all kinds of arguments break out among men, even within the closest families. Morality and mutual respect seem to break down. In case you’re interested: what you’re witnessing is the ‘Fimbulwinter’, the first clear sign the world is about to end.

Now, brace yourself. You’re going to witness the first in a series of HUGE apocalyptic surprises. For what on Earth is that? Suddenly, you see a huge wolf flying overhead. It flies across the sky, like some weird kind of airplane. That, my friend, is the mythical wolf Skoll. And before you know what’s happening, it eats up the Sun. And wait -- there goes the moon, too!

From that moment on, it gets crazier and crazier. The ground starts to shudder. Trees are launched, even complete mountains fall over. And then, suddenly, you see this outlandishly dressed guy emerging out of nowhere. It is Loki, supreme bad guy for the Vikings. He is set free by the earthquakes -- and ready to pick a fight.

Loki is not alone. Next to him, you see another supernatural wolf. It’s Loki’s son, Fenrir. The beast has a HUGE mouth: its lower jaw scrapes the ground, while the upper jaw touches the sky.

Right after that, you hear a sharp, screeching sound. Could that be… a cock crowing? Yes: it is. In fact, there are three of them. Cock number one, a red animal, crows to the giants. Cock number two, a golden bird, calls in the gods. And cock number three, a rusty brown animal, raises the dead from hell.

You rub your eyes. This can’t be happening, you keep telling yourself.But it is. Next thing you know, the sea starts to roar violently. There’s a colossal tsunami, and then, the next bad guy enters the stage. A gargantuan serpent rises out of the sea. It is Jormungand, a venomous snake out of hell.

From that moment on, things go from bad to worse. Everywhere around the globe, all kinds of gods and beasts

and demons and giants start showing up. Some come in ships, others on horseback, still others come walking. They're all heavily armed, with divine swords, magical spears, and all kinds of other supernatural stuff. And they seem to be in a bad mood.

Now, if you happen to live in Norway, better take shelter. For Norway is where all these weird creatures are heading. That's where the final battle is to be fought, on a battlefield called Vigrid.

In total amazement, you watch on TV what's unfolding. From the east comes the huge sailing ship Naglfar, commanded by the giant Hymir. Look, there comes Loki again, aboard another huge boat, full of demons he brought in from hell. From the south comes Surt, another sinister warrior leading an army of giants. Don't try to talk him out of it: he'll instantly incinerate you with his mighty sword, which is as hot as the Sun itself. Carelessly, Surt turns every city he passes into a smoking rubble.

And there's more to come. In the south, people witness how a fierce hell hound named Garm rushes in to team up with the fire giants. In the meantime, you won't be able get a night's rest: the pitch-black sky is filled with eerie woes, explosions and echoes. Why do these apocalypses always come with all of these special effects?

On the battlefield, one lonely god hangs around. It's the good Viking god named Heimdall. And when he sees all these giants and demons and beasts approaching, he picks up his horn and blows it, to wake up the gods. It will be some sound: it is heard throughout the entire world.

So: the gods wake up. There's Odin, and Thor, and all the others. What do they do? Well: they sit down, have a few drinks and have a meeting.

Yggdrasil, the Tree of the World

On Earth, we will of course not notice this. What we do notice, is another weird apocalyptic event. You may not know this, but somewhere in heaven, there's a very special tree called Yggdrasil. It is the Tree of the World, the living embodiment of everything and everyone that ever was and ever will be on this planet. And now, Yggdrasil shivers. From its deepest root up to its highest branches, it shakes. You should feel this shaking from deep within: it is your very existence itself, that shivers. Everything on Earth and in heaven and hell will quiver, the Viking legends foresee.

Meanwhile, the gods finally arrive at the battlefield. They look exactly as you would expect them to: dressed in shiny, golden armor, and riding beautiful white horses. The upper god Odin rides at the head.

Then, it’s battle time. It goes something like this:

Odin jumps Fenrir, while Thor is attacked by Jormungand and Freyr clashes with Surt, but unfortunately Freyr gave his sword to Skirnir, so Surt wins, while Tyr kills Garm but then dies himself, just like Heimdall and Loki fight each other to death and Thor dies after killing Jormungand with his hammer Mjollnir, while Odin is eaten by Fenrir, after which Vidar gets so pissed off he kills Fenrir by tearing off its head, which annoys Surt so much he sets the entire world on fire, killing everyone else.

And after that, all land sinks into the sea. Finally, it gets quiet.

So, exit mankind? And bye-bye gods? Not quite. Miraculously, a few gods survive. And fortunately, they belong to the good guys: Odin’s brother and sons Vili, Vali and Vidar, Thor’s sons Magni and Modi and a few other blokes, named Honir, Balder and Hod. Even more miraculously, two people survive. They’re named Lif and Lifthrasir -- the Viking version of Adam and Eve, so to say. They have endured the events by hiding deep within the tree Yggdrasil.

And it gets better. After a while, up rises an entire new world from the sea. It’s a heavenly place, with lush fields and plenty of corn waiting to be harvested. The Sun is reborn, and so is the moon. Balder takes it on him to lead the gods of this new world, and Lif and Lifthrasir worship Balder and his gods.

Slowly, the world is repopulated by the descendents of Lif and Lifthrasir. Fortunately for them, World No. 2 is a much better place than our current world ever was. For one thing, evil no longer exists. There will be no sword-fighting, no nit-picking, gossiping, cheating, stealing, killing or breaking the speed limit with your car. Finally, mankind will live in complete and utter harmony.

It’s a pity you won’t be there to join in. According to the ancient Viking writings called the Edda, which describe all these events, you will have died in the fire unleashed by Surt. Or, if you somehow managed to survive that, you would have drowned in the big sinking of all land afterwards.

But even then, your soul still exists. By now, you should find yourself in the renewed, totally reconstructed Viking heaven. There are many rooms there, and their quality varies wildly. If you’re very lucky, you get to live with the gods in a place called Gimli, which is a huge, sunlit building with a golden roof. Or you might find yourself in Brimir, another beautiful place with drinks galore.

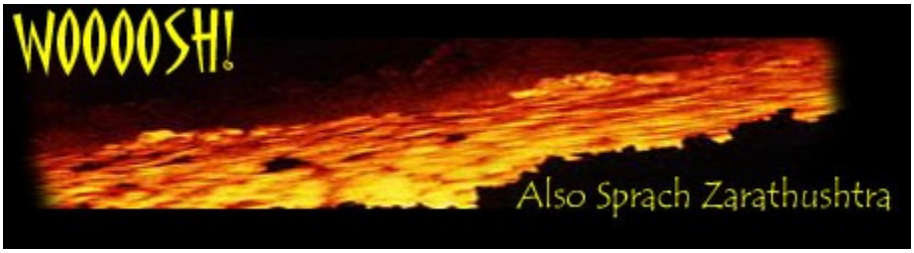
But on the other hand, if you behaved badly during life, you could end up in a dark hole called Nastrond. That means ‘corpse strand’, a description that pretty much says it all. Nastrond is a dark dungeon, with walls and roofs made of snakes. You will have to wade through a river of venom for eternity.

No offense to the Vikings, but somehow we at Exit Mundi have some doubts about the reality of Ragnarok. It seems to be just what it is: a Viking myth. Not too many people believe in it anymore -- if there are any people who still take it literally, that is.

On the other hand, plenty of modern day people seriously accept the idea that one day, the world will be terminated by four horsemen and a horde of huge locusts from a pit. That, at least, is how it goes in the Christian end of times, the Apocalypse of St. John.

So who is right? Who is wrong? Guess we’ll just have to sit back, and wait. But should that terrible winter come -- better hide in that tree!

ZARATHUSTRA



Think of Islam what you will -- its presence in what used to be Persia may have a downside. For the coming of Islam actually marks the beginning of the End of Days. In fact, we may be about to drown in molten metal. That's at least what God told the Persian prophet Zarathushtra some 3,000 years ago.

Long before Islam, long before Christianity, there was Zoroastrianism: an ancient Persian religion, based on the mystic writings of the prophet Zarathushtra. Now God (Ahura Mazda in Zoroastrian) told Zarathushtra a lot of stuff. Among things, God told the prophet in detail how the world will end. Here's the full story.

It all starts to go wrong when what's now called Iran is overrun by a race of `demons' of questionable nationality, coming from the East. The demons have disheveled hair and practice a `vile religion'. Iran will be in decay for a thousand years: the economy is disrupted, government is bad, and the people of Iran and it's neighbors will be very unkind and hostile to each other.

Also, the entire world will look different. The Sun is more often unseen and is spotted, harvests will be bad, and years, months and days are one third shorter.

Strangely, countries will be full of highways. Humans have also changed. They are born smaller and weaker, and talk a lot of good deeds, but do the adversary. The world is covered with `dead matter': everywhere you go, you step on it. No wonder almost everyone living in this wicked world goes straight to hell after death.

But wait. Then, suddenly, weird and cataclysmic things start happening. There are notable more earthquakes and devastating storms. There are signs on the Sun, and the moon suddenly becomes colored. From the Balkans, an army with `red weapons, red banners and red hats' emerges. The army wages war on Greece -- and wins. It's the beginning of a series of wars, in which Arabs, Turks and the Balkans play prominent roles. But there are no good guys around, the one army is as evil as the next.

Gladly, help is underway. Somewhere in Asia (China or India, Zarathustra suggests), a prince is born. The prince's mother is a virgin, and the birth is marked by yet another divine signal: at the moment of birth, a star falls from the sky, for everyone to be seen.

By the time the prince ages thirty, he gathers an enormous army around him, with flags striped like tiger skins. The prince leads his army to Iran and defeats all the bad guys, demonic invaders included. He knows how to take care of business: `They will slay so that a thousand women can afterwards see and kiss, but one man', Zarathushtra says.

But the prince's victory really pisses off the general manager of the demons, Evil itself. The devil summons yet another army, consisting of the `vilest races of demons and wrath', and goes to Iran.

Of course, Ahura Mazda doesn't leave this unanswered. He sends in an angel called Neryosang and another godly creature called Srosh the righteous. Together with 150 faithful men, and under the leadership of a prophet called Peshotan, the prince goes out to restore religion. They bless everyone they meet, consecrate every pool of water they pass, and every now and then, they kick ass when they come across a demon or an evil race.

Meanwhile, Ahura Mazda keeps sending in more troops. He descends to the mountain of Hukairya with his archangels, and tells them to join Peshotan. From his mountaintop, Ahura Mazda gives away a thundering pep-talk to the troops. It scares the hell out of the devil. Shocked, he `flees back to the darkest recess of hell', avoiding battle with the armies of God. Score 1-0 in favour of Ahura Mazda.

But evil isn't quite defeated yet. Another thousand years pass, and steadily, the devil makes a comeback. Once more, the world becomes corrupted. People grow more and more wicked, and religion is contaminated with evil and malpractice again. Then, one day, God decides it's time for another savior.

So here we go once more. Somewhere in the East, a virgin takes a bath and becomes miraculously impregnated. She gives birth to messiah number two, a chap named Aushedar. At the age of thirty, Aushedar sees the light and receives the Zoroastrian religion directly from Ahura Mazda himself. Aushedar commands the Sun to halt, and indeed it does: for ten days and ten nights, the Sun just sits there in the sky.

And if you think that's miraculous, wait what happens next. From every corner of the world wolves come running to Iran. There, they melt together into a gigantic, hideously looking, demonic Super wolf. The beast is 433 paces long and stretches 415 paces across. Now that's what you call a wolf!

Oh, not Aushedar. Rapidly, the savior gathers an army of Ahura Mazda-worshippers around him, battles the wolf, and kicks it back into hell. Phew!

And that's about all Aushedar has to do. Everyone is so impressed that all humans hastily decide not to flirt with Mr. Evil anymore. En masse, they give the devil the finger, and convert to the good religion of Ahura Mazda again. Grudgingly, the Devil retreats into darkness once more. 2-0 for God.

Another thousand years pass, and although evil is groggy and weakened by now, it's still around. From the Balkans and from the East, new armies roll in. Again they conquer Iran, and again Ahura Mazda sees his religion corrupted and degraded. The world has undergone some remarkable changes by now. For one thing, people no longer need to eat to stay alive.

But Ahura Mazda has really had it with the Devil. He decides to send in a third messiah and bring about the end of the world. In Iran, a beautiful virgin takes a bath in lake Kansaoya -- and, oh wonder, she becomes pregnant.

The third savior is born and finds out he is, other than the preceding saviors, a direct descendant of Zarathushtra himself. Saoshyant, is the name of messiah number three. And it is clear he will be the last messiah in a row: while he still is a young man, some very odd things start to happen.

For one thing, all the dead begin coming back to live. One after another, they crawl out of their graves with brand new bodies. All in all, the whole process lasts 57 years. Everyone who died as a youth will be aged eighteen forever, everyone who died as an adult will be forty for eternity.

Oh, that's nice, you think. But wait. Ahura Mazda didn't resurrect the dead for fun. For the next moment, a huge, holy comet plummets into the earth. Boom! The comet hits the earth `like a wolf jumping a sheep', Ahura Mazda tells Zarathushtra.

The comet melts all mountains and ploughs open the earth's crust, exposing all the metal in the world, and melting that too. A super hot tidal wave of molten metal

races across the entire planet. Before you can say `Ahura Mazda', you're swimming in liquid steel.

But it's a wave of judgment, really. The molten metal takes the shape of a river, and everyone has to cross it. Whoever was evil in life suffers terrible pains. The more you did wrong, the more you suffer. But what the heck: in the end, you'll find out you're truly purified of sin. The molten metal literally burns away every scratch of evil from your soul. O, and by the way: if you were already pure of heart, you survive the wave without any problem at all. The molten metal will feel like warm milk, as Zarathushtra puts it.

So the earth is a nice place to be again. Mankind is purified, families reunite, and there's love and peace all over the place. Happy endings? No, not yet. There's one nasty little job left. For once and for all, mankind has got to get rid of evil.

So before you know it, it's war again. In the sky, angels battle against demons, and on earth, men battle against, well, *more* demons. Of course, Saoshyant and his good guys win. The devil and everything he ever created -- except the darkness of the night! -- is kicked off the planet. Everything mankind considers evil is thrown back into where it came from: hell.

And that isn't it. Now, Ahura Mazda himself comes into action. He picks up hell, and tosses it into the metal river, all demonic inhabitants included. Hell burns up. When it's done, there's nothing left but a purified stretch of peaceful countryside. Ahura Mazda fits the land that used to be hell in into the world, enlarging our planet quite a bit.

Finally, it's heaven on earth. Men will live forever, without wars, without any problem. They will not have to eat or drink. They accept the will of God joyfully. Even the land is more peaceful than ever: there are no more mountains or slopes, just green, beautiful pastures. Welcome to the Brand New Earth, the world according to Ahura Mazda!

So... should we worry?

Zarathushtra's visions were a big hit: Zoroastrianism instantly became the hottest religion in Persia, and remained all-important for many centuries to come. Interestingly, many elements of Zarathushtra's writings trickled down into the texts of Christianity, Judaism and Islam. Not only was Zoroastrianism the first monotheistic religion, Zarathushtra was the first to introduce the doctrines of final judgment and the coming of a messiah to save humanity from evil. Let alone those striking parallels between the birth of Christ and the birth of the Zoroastrianist messiah's!

Zarathushtra's prophecy, if taken literally, has some interesting features to it. Indeed, the religion of Ahura Mazda has gone into oblivion because of hostile people invading Persia. In 651 or 652 AD Muslims conquered Persia, and in the ninth century, Zoroastrianism was effectively banned. By now there are some 100,000 Zoroastrianists left, mostly in India, where a small colony of Zoroastrians took refuge long ago. And yes, there have been `red armies' in the Balkans. Oh, and there are plenty of highways running through Iran.

Some people indeed take Zarathushtra's prophecies for real.A peculiar spin-off from Zoroastrianism is the Baha'i faith, which claims its founder Baha'u'llah in fact is the messiah Saoshyant. According to some Zoroastrian scriptures Saoshyant would be born `when a thousand two hundred and some years have passed from the inception of the religion of the Arabian'. Now the Islamic calendar begins in the year 622 AD, so Saoshyant's birth must be somewhere in the mid-1800s. And hey, look who was born in the mid-1800s? You guessed it: Baha'i's founding father, Baha'u'llah.

So it can't be long before we are purified by this awesome river of molten metal, right? Oh, come on! For one thing, Ahura Mazda told Zarathushtra he would bring about the end of time in three thousand years. But since Zarathushtra lived some 1,000 or 600 years before Christ, at least some of the predictions should already have come true.

But days and years are definitely not one third shorter. People still need food (well, at least Exit Mundi does). And last but not least: although some Christian extremists think otherwise, it is WAY out of line to say Islam is a `vile religion' run by demons.

A more down to earth reassurance we won't have to bathe in molten metal before long pops up when you have a closer look at the historic context of the Zoroastrian apocalyptic. There are many different versions of Zarathushtra's vision -- it took Exit Mundi weeks of reading to come up with the scenario of doom and destruction outlined above. In one version, the first two saviors are nameless figures. In other texts, there is yet another savior, a guy by the name of Aushedar-mah.

The reason for all confusion is that the Zarathushtra scenario was rewritten over and over again by later generations of Zoroastrianists. As their religion became persecuted in the ninth century, the apocalyptic became very important in Zoroastrianism. Ahura Mazda-worshippers everywhere in Persia clung to their apocalyptic writings for comfort, its bottom line being that eventually, Zoroastrianism will win. Zoroastrianists thus elaborated on the story, filling in many details and coming up with completely new predictions of the apocalypse to come.

In that respect, taking the Zoroastrian end of days too seriously would be much like believing in Father Xmasses or Boogie Men. Well, at least that's Exit Mundi's opinion on matters. And when that big, mean river of molten metal arrives after all, oh boy, will we suffer!

ZOMBIES

And then, there's the unpleasant Dawn of the Dead – the end of times in which we are all eaten up by flesh-hungry zombies. Could it really happen?

One day, you wake up to find the little girl next door in your hallway. She just stands there, quietly looking at you. You rub your eyes and begin to ask her what's up. But then… she jumps you.

To your bewilderment, she buries her teeth deep into your neck. Blood gushes all over the place. You die. But then again, you don't. A few seconds later, you kind of wake up again. You're unable to speak or think. Your personality is gone, locked away behind the gates of death. All that remains is a walking, decaying, bad-breathed corpse that used to be you. A deep roar escapes from your lips. You're so… hungry!

Pretty soon, the world is overrun by zombies just like you. There are living dead in the streets. Living dead in the shops. Living dead in every house. Living dead gathering around every last band of normal humans. On the internet, there's a pretty amazing computer simulation that shows what would happen if the living dead were to really overrun us. Bottom line: humans wouldn't stand a chance!

The zombie scenario comes in many forms. In some movies and books, a virus turns us into living dead. In others, a chemical mishap wakes up the deceased. In still others, it remains unclear what causes all the trouble. And maybe that's all the better. Because no matter how you look at it, corpses that walk and kill are of course somewhat… unrealistic.

Zombies defy all logic. How can someone who has been injured so badly that he can no longer live still, ehm… live? How can a rotting cadaver still stumble about and kill you? Why would it go after living humans in the first place? Wouldn't it be easier if it just cooked itself a meal? Or go to Burger King: with a bad breath like that, they'll surely let you go first.

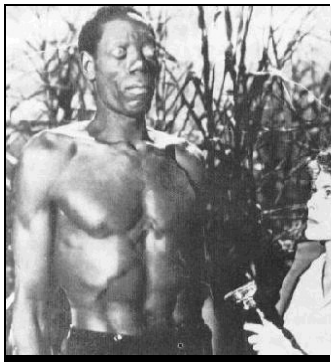
Zombies: the facts

Fortunately, there is no known condition that turns dead people into cannibalistic killer corpses. Usually, dead is dead.

Indeed, some of us have made it back to the land of the living, for example after reanimation in the hospital. But usually they don't wake up with a particular appetite for raw human flesh -- even though they have good reason for that, considering the food they serve in hospitals.

Yes, there are a few rare conditions that transform people into dangerous, raging psychopaths – the Indonesian disorder called 'amok' is the most well-known. But diseases like that have nothing to do with death nor cannibalism – and they aren't contagious at all.

Still, movies, books, comics and computer games have told and retold the zombie scenario again and again. One of the earliest examples is Edgar Allen Poe's short story 'The Facts in the Case of M. Valdemar' (1844), in which a terminally ill guy slowly turns into a living but rotting corpse after he is being kept from dying by hypnosis. Among the most recent examples are the blockbusters 'Dawn of the Dead' (2004) and '28 Days Later' (2002) – the storyline we started this page with comes from Dawn of the Dead.



Zombies galore: In early day movies like "I Walked With a Zombie" (1943), the zombie was still a conjured guy -- not a flesh eating corpse.

At the moment, there are at least 91 zombie movies we know of (see this list). And the theme has many variations, ranging from the Body Snatchers-movies and The Borg from Star Trek to even The Matrix, in which humans are turned into living dead batteries.

So: why is it so popular? Why do zombies scare the hell out of us? Obviously, much of it has to do with our instinctive fear of death and our in-built disgust of dead bodies. Corpses and cannibalism – these are two of our deepest taboos, and breaking them scares the shit out of us.

On a deeper level, some of it has to do with mass psychology and sociology. In western society, freedom, individualism and

being able to make up your mind are considered the highest goods. Zombies are quite the opposite, the nightmare to the dream. They are the ultimate de-humanized beings.

And then there's the link with voodoo. Originally, 'zombie' is the African word for a conjured slave. Several West-African religions share the belief that a sorcerer can transform someone into a slave by stealing his memory, his awareness and his will. No rotting corpses involved – just an average guy, turned into a will-less slave.

In American slave times, this idea mixed with ancient European superstitions. For example, in New Orleans around 1800, white and black folks alike feared a 'zombie' that was said to haunt the streets. But the zombie involved had nothing to do with rotting corpses. It was the ghost apparition of a deceised French officer holding his head under his arm!

On the isle of Haiti, the word 'zombie' took another twist. In 1801, the Haitian slaves revolted and kicked the whites off of their island – interestingly, their leader was a conjurer-priest, Toussaint L'Overture, who promised his followers they wouldn't die during the uprising.

I, zombie: A real Haitian zombie, made ill by poison.

After that, the former slaves founded the voodoo faith, a religion that is part catholic, and part African. Just like in Africa, Haitian voodoo-followers believe you can turn someone into a zombie, as a means of punishment. In Haiti, voodoo priests used and use puffer fish poison ('tetrodotoxin') to accomplish this. The poison, administered as a powder, produces a deep, dead-like coma first, and then a lethargic, vegetative state of non-being.

It was only in the 1960s Hollywood came up with the modern day zombie: the one that bites. The watershed movie that gave the zombies their new image was the legendary horror classic 'Night of the Living Dead' (1968).

In the meantime, quite a few real 'zombies' live in Haitian mental hospitals. But they don't bite. They are normal, living people, turned into plants by vicious poison. So in fact, we should feel sorry for the zombies. Those poor, poor living dead!